2007 -2008

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY
HYDERABAD
B.TECH. AERONAUTICAL ENGINEERING

I Year

Code	Subject	T	P/D	C
	English	2+1*	0	4
	Mathematics-I	3+1*	0	6
	Engineering Physics	2+1*	0	4
	Engineering Mechanics	3+1*	0	6
	Numerical Methods	3+1*	0	6
	C Programming and data structures	3+1*	0	6
	Engineering Graphics	0	6	8
	Introduction to Aerospace Engineering	2	0	4
	Computer Programming Lab	0	3	4
	Engineering Work Shop Practice	0	3	4
	English Language Communication skills Lab	0	3	4
	TOTAL	**24**	**15**	**56**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY
HYDERABAD
B.TECH. AERONAUTICAL ENGINEERING

II Year I Semester COURSE STRUCTURE

Code	Subject	T	P	C
	Mathematics-II	4+1 *	0	4
	Thermodynamics	4+1*	0	4
	Foundation of Solid Mechanics	4+1*	0	4
	Mechanics of Fluids	4+1*	0	4
	Aircraft Engineering Drawing	0	6	4
	Environmental Studies	4+1*	0	4
	CAD Lab	0	3	2
	Mechanics of Solids and Mechanics of Fluids Lab	0	3	2
	TOTAL	**25**	**12**	**28**

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HYDERABAD
B.TECH. AERONAUTICAL ENGINEERING

II Year II Semester COURSE STRUCTURE

Code	Subject	T	P	C
	Mathematics for Aerospace Engineers	4+1*	0	4
	Aerodynamics – I	4+1*	0	4
	Aircraft Production Technology	4+1*	0	4
	Electrical and Electronics Engineering	4+1*	0	4
	Aerospace Materials and Composites	4+1*	0	4
	Mechanisms and Mechanical Design	4+1*	0	4
	Aircraft Materials and Production Lab	0	3	2
	Electrical and Electronics Engineering Lab	0	3	2
	TOTAL	**30**	**6**	**28**

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY
HYDERABAD
B.TECH. AERONAUTICAL ENGINEERING

III Year I Semester COURSE STRUCTURE

Code	Subject	T	P	C
	Management Science	4+1*	0	4
	Flight Mechanics-I	4+1*	0	4
	Aerodynamics – II	4+1*	0	4
	Aerospace Vehicle Structures – I	4+1*	0	4
	Aerospace Propulsion – I	4+1*	0	4
	Control Systems	4+1*	0	4
	Advanced English Communication Skills Lab	0	3	2
	Aerodynamics and Propulsion Lab	0	3	2
	TOTAL	**30**	**6**	**28**

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III Year II Semester COURSE STRUCTURE

Code	Subject	T	P	C
	Flight Mechanics-II	4+1*	0	4
	Aerospace Vehicle Structures -II	4+1*	0	4
	Aerospace Propulsion - II	4+1*	0	4
	Flight Vehicle Design	4+1*	0	4
	Finite Element and Modeling Methods	4+1*	0	4
	Introduction to Space Technology	4+1*	0	4
	Aerospace Structures Lab	0	3	2
	Flight Vehicle Design Lab	0	3	2
	TOTAL	**30**	**6**	**28**

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IV Year I Semester COURSE STRUCTURE

Code	Subject	T	P	C
	Vibrations and Structural Dynamics	4+1*	0	4
	Computational Aero Dynamics	4+1*	0	4
	Structural Analysis and Detailed Design	4+1*	0	4
	Avionics	4+1*	0	4
	ELECTIVE - I	4+1*	0	4
	Experimental Stress Analysis			
	Analysis of Composites Structure			
	Airport Management			
	Engineering Optimization			
	Industrial Aerodynamics			
	ELECTIVE - II	4+1*	0	4
	Air Line Management			
	CAD/CAM			
	Rockets and Missiles			
	Propellant Technology			
	Neural Networks and Fuzzy Logic			
	Computational Structural and Aerodynamics Lab	0	3	2
	Structural Analysis and Detailed Design Lab	0	3	2
	TOTAL	**30**	**6**	**28**

IV Year II Semester

Code	Subject	T	P	C
	Aircraft Systems and Instrumentation	4+1*	0	4
	ELECTIVE – III	4+1*	0	4
	System Modeling and Simulation			
	Advanced Computational Aerodynamics			
	Helicopter Engineering			
	Hypersonic Aerodynamics			
	Space Mechanics			
	ELECTIVE – IV	4+1*	0	4
	Fatigue and Fracture Mechanics			
	Boundary Layer Theory			
	Aircraft Maintenance Management			
	Heat Transfer			
	Aeroelasticity			
	Industry Oriented Mini Project	0	0	2
	Seminar	0	0	2
	Project Work	0	0	10
	Comprehensive Viva	0	0	2
	TOTAL	**15**	**0**	**28**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY
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I Year B. Tech. AE

T	P	C
2+1*	0	4

ENGLISH

1. INTRODUCTION :

In view of the growing importance of English as a tool for global communication and the consequent emphasis on training students to acquire communicative competence, the syllabus has been designed to develop linguistic and communicative competence of Engineering students. The prescribed books and the exercises are meant to serve broadly as students' handbooks.

In the English classes, the focus should be on the skills of reading, writing, listening and speaking and for this the teachers should use the text prescribed for detailed study. For example, the students should be encouraged to read the texts/selected paragraphs silently. The teachers can ask comprehension questions to stimulate discussion and based on the discussions students can be made to write short paragraphs/essays etc.

The text for non-detailed study is for extensive reading/reading for pleasure by the students. Hence, it is suggested that they read it on their own with topics selected for discussion in the class. The time should be utilized for working out the exercises given after each section , as also for supplementing the exercises with authentic materials of a similar kind for example, from newspaper articles, advertisements, promotional material etc.. *However, the stress in this syllabus is on skill development and practice of language skills.*

2. OBJECTIVES:

a. To improve the language proficiency of the students in English with emphasis on LSRW skills.

b. To equip the students to study academic subjects with greater facility through the theoretical and practical components of the English syllabus.

c. To develop the study skills and communication skills in formal and informal situations.

3. SYLLABUS :

Listening Skills:

Objectives

1. To enable students to develop their listening skill so that they may appreciate its role in the LSRW skills approach to language and improve their pronunciation
2. To equip students with necessary training in listening so that can comprehend the speech of people of different backgrounds and regions

Students should be given practice in listening to the sounds of the language to be able to recognise them, to distinguish between them to mark stress and recognise and use the right intonation in sentences.

- Listening for general content
- Listening to fill up information
- Intensive listening
- Listening for specific information

Speaking Skills :

Objectives

1. To make students aware of the role of speaking in English and its contribution to their success.
2. To enable students to express themselves fluently and appropriately in social and professional contexts.

- Oral practice
- Describing objects/situations/people
- Role play – Individual/Group activities (Using exercises from all the nine units of the prescribed text: *Learning English : A Communicative Approach*.)
- Just A Minute(JAM) Sessions.

Reading Skills:

Objectives

1. To develop an awareness in the students about the significance of silent reading and comprehension.
2. To develop the ability of students to guess the meanings of words from context and grasp the overall message of the text, draw inferences etc.

- Skimming the text
- Understanding the gist of an argument
- Identifying the topic sentence
- Inferring lexical and contextual meaning
- Understanding discourse features
- Recognizing coherence/sequencing of sentences

NOTE : *The students will be trained in reading skills using the prescribed text for detailed study. They will be examined in reading and answering questions using 'unseen' passages which may be taken from the non-detailed text or other authentic texts, such as magazines/newspaper articles.*

Writing Skills :

Objectives

1. To develop an awareness in the students about writing as an exact and formal skill
2. To equip them with the components of different forms of writing, beginning with the lower order ones.

- Writing sentences
- Use of appropriate vocabulary
- Paragraph writing
- Coherence and cohesiveness
- Narration / description
- Note Making
- Formal and informal letter writing
- Editing a passage

4. TEXTBOOKS PRESCRIBED:

In order to improve the proficiency of the student in the acquisition of the four skills mentioned above, the following texts and course content, divided into **Eight Units**, are prescribed:

For Detailed study

1. **LEARNING ENGLISH:** ***A Communicative Approach***, Hyderabad: Orient Longman, 2006. (Six Selected Lessons)

For Non-detailed study

2. **WINGS OF FIRE:** ***An Autobiography – APJ Abdul Kalam***, Abridged version with Exercises, Universities Press (India) Pvt. Ltd., 2004.

A. STUDY MATERIAL:

Unit –I

1. Astronomy from LEARNING ENGLISH: *A Communicative Approach,* Orient Longman, 2005.
2. Chapters 1-4 **from** Wings of Fire**:** An Autobiography **– APJ Abdul Kalam, an abridged version with Exercises, Universities Press (India) Pvt. Ltd.,2004**

Unit –II

3. Information Technology **from** LEARNING ENGLISH: *A Communicative Approach,* **Orient Longman, 2005.**
4. Chapters 5-8 **from** Wings of Fire**:** An Autobiography **– APJ Abdul Kalam, an abridged version with Exercises, Universities Press (India) Pvt. Ltd.,2004**

Unit –III

5. Humour **from** LEARNING ENGLISH: *A Communicative Approach,* **Orient Longman, 2005.**
6. Chapters 9-12 **from** Wings of Fire**:** An Autobiography **– APJ Abdul Kalam, an abridged version with Exercises., Universities Press (India) Pvt. Ltd.,2004**

Unit –IV

7. Environment **from** LEARNING ENGLISH: *A Communicative Approach,* **Orient Longman, 2005.**
8. Chapters 13-16 **from** Wings of Fire**:** An Autobiography **– APJ Abdul Kalam, an abridged version with Exercises, Universities Press (India) Pvt. Ltd.,2004**

Unit –V

9. Inspiration **from** LEARNING ENGLISH: *A Communicative Approach,* **Orient Longman, 2005.**
10. Chapters 17-20 **from** Wings of Fire**:** An Autobiography **– APJ Abdul Kalam, an abridged version with Exercises, Universities Press (India) Pvt. Ltd.,2004.**

Unit – VI

11. Human Interest **from** LEARNING ENGLISH: *A Communicative Approach,* **Orient Longman, 2005.**
12. Chapters 21-24 **from** Wings of Fire**:** An Autobiography **– APJ Abdul Kalam, an abridged version with Exercises, Universities Press (India) Pvt. Ltd., 2004.**

* Exercises from the lessons not prescribed shall also be used for classroom tasks.

Unit – VII

Exercises on

Reading and Writing Skills
Reading Comprehension
Situational dialogues
Letter writing

Essay writing

Unit – VIII

Practice Exercises on Remedial Grammar covering

Common errors in English, Subject-Verb agreement, Use of Articles and Prepositions, Tense and aspect

Vocabulary development covering

Synonyms & Antonyms, one-word substitutes, prefixes & suffixes, Idioms & phrases, words often confused.

REFERENCES :

1. **Strengthen Your English,** Bhaskaran & Horsburgh, Oxford University Press
2. **Basic Communication Skills for Technology**, Andrea J Rutherfoord, Pearson Education Asia.
3. **Murphy's English Grammar with CD,** Murphy, Cambridge University Press
4. **English Skills for Technical Students** by Orient Longman
5. **Everyday Dialogues in English** by Robert J. Dixson, Prentice-Hall of India Ltd., 2006.
6. **English For Technical Communication**, Vol. 1 & 2, by K. R. Lakshmi Narayanan, Sci tech. Publications.
7. **A Hand book of English for Engineers & Technologists** by Dr. P. Eliah, B. S. Publications.
8. **Developing Communication Skills** by Krishna Mohan & Meera Benerji (Macmillan)
9. **Speaking and Writing for Effective Business Communication,** Francis Soundararaj, MacMillan India Ltd., 2007.
10. **The Oxford Guide to Writing and Speaking,** John Seely, Oxford

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I Year B. Tech. AE

T	P	C
3+1*	0	6

MATHEMATICS – I

UNIT – I
Differential equations of first order and first degree – exact, linear and Bernoulli. Applications to Newton's Law of cooling, Law of natural growth and decay, orthogonal trajectories.

UNIT – II
Non-homogeneous linear differential equations of second and higher order with constant coefficients with RHS term of the type e^{ax}, Sin ax, cos ax, polynomials in x, e^{ax} V(x), xV(x), method of variation of parameters.

UNIT – III
Rolle's Theorem – Lagrange's Mean Value Theorem – Cauchy's mean value Theorem – Generalized Mean Value theorem (all theorems without proof) Functions of several variables – Functional dependence- Jacobian- Maxima and Minima of functions of two variables with constraints and without constraints

UNIT – IV
Radius, Centre and Circle of Curvature – Evolutes and Envelopes Curve tracing – Cartesian , polar and Parametric curves.

UNIT – V
Applications of integration to lengths, volumes and surface areas in Cartesian and polar coordinates multiple integrals - double and triple integrals – change of variables – change of order of integration.

UNIT – VI
Sequences – series – Convergences and divergence – Ratio test – Comparison test – Integral test – Cauchy's root test – Raabe's test – Absolute and conditional convergence

UNIT – VII
Vector Calculus: Gradient- Divergence- Curl and their related properties of sums- products- Laplacian and second order operators. Vector Integration - Line integral – work done – Potential function – area- surface and volume integrals Vector integral theorems: Green's theorem-Stoke's and Gauss's Divergence Theorem (With out proof). Verification of Green's - Stoke's and Gauss's Theorems.

UNIT – VIII
Laplace transform of standard functions – Inverse transform – first shifting Theorem, Transforms of derivatives and integrals – Unit step function – second shifting theorem – Dirac's delta function – Convolution theorem – Periodic function - Differentiation and integration of transforms-Application of Laplace transforms to ordinary differential equations Partial fractions-Heaviside's Partial fraction expansion theorem.

TEXT BOOKS:

1. A text Book of Engineering Mathematics, Vol-1 T. K. V. Iyengar, B. Krishna Gandhi and Others, S. Chand & Company.
2. A text Book of Engineering Mathematics, C. Sankaraiah, V. G. S. Book Links.
3. A text Book of Engineering Mathematics, Shahnaz Bathul, Right Publishers.
4. A text Book of Engineering Mathematics, P. Nageshwara Rao, Y. Narasimhulu & N. Prabhakar Rao, Deepthi Publications.

REFERENCES:

1. A text Book of Engineering Mathematics, B. V. Raman, Tata Mc Graw Hill.
2. Advanced Engineering Mathematics, Irvin Kreyszig, Wiley India Pvt. Ltd.
3. A text Book of Engineering Mathematics, Thamson Book Collection.

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T	P	C
2+1*	0	4

ENGINEERING PHYSICS

UNIT I

OPTICS : Interference - Superposition of waves - Young's double slit experiment – Coherence - Interference in thin films by reflection - Newton's rings - Diffraction - Fressnel and Fraunhofer diffractions - Fraunhofer diffraction at a Single slit – Double slit - Diffraction grating - Grating spectrum - Resolving power of a grating - Rayleigh's criterion for resolving power – Polarization - Types of Polarization – Double refraction – Nicol prism.

UNIT II

ULTRASONICS : Introduction - Production of ultrasonic waves - Magnetostriction method – Piezo electric method - Detection of ultrasonic waves - Properties of ultrasonic waves - Use of ultrasonics for nondestructive testing - Applications of ultrasonics.

ACOUSTICS OF BUILDINGS: Basic requirement of acoustically good hall - Reverberation and time of reverberation – Sabine's formula for reverberation time - Measurement of absorption coefficient of a material - Factors affecting the architectural acoustics and their remedy.

UNIT III

MAGNETIC PROPERTIES: Permeability - Magnetization - Origin of magnetic moment – Classification of magnetic materials - Dia, para and ferro magnetism - Hysteresis curve - Soft and hard magnetic materials.

SUPERCONDUCTIVITY: General properties - Meissner effect - Penetration depth - Type I and Type II superconductors - Flux quantization – DC and AC Josephson effect –BCS Theory - Applications of superconductors.

UNIT IV

CRYSTAL STRUCTURES AND X-RAY DIFFRACTION: Introduction -Space lattice - Basis - Unit cell - Lattice parameter - Bravais lattices – Crystal systems - Structure and packing fractions of Simple cubic - Body centered cubic – Face centered cubic crystals - Directions and planes in crystals – Miller indices - Separation between successive [h k l] planes - Diffraction of X-rays by crystal planes - Bragg's law - Laue method - Powder method.

UNIT V

LASERS : Introduction - Characteristics of lasers - Spontaneous and stimulated emission of radiation - Einstein's coefficients - Population inversion - Ruby laser - Helium-Neon laser – CO_2 laser - Semiconductor laser - Applications of lasers in industry, scientific and medical fields.

UNIT VI

FIBER OPTICS AND HOLOGRAPHY: Introduction - Principle of optical fiber - Acceptance angle and acceptance cone - Numerical aperture – Types of optical fibers and refractive index profiles – Attenuation in optical fibers - Application of optical fibers – Basic principles of holography – Construction and reconstruction of image on hologram – Applications of holography.

UNIT VII

DIELECTRIC PROPERTIES: Introduction - Dielectric constant - Electronic, ionic and orientational polarizations - Internal fields in solids – Clausius - Mossotti equation – Dielectrics in alternating fields – Frequency dependence of the polarizability - Ferro and Piezo electricity.

THERMAL PROPORTIES : Introduction - Specific Heat of Solids – Einstein Model – Debye Model – Lattice Vibrations – Phonons – Thermal Conductivity.

UNIT VIII

SCIENCE & TECHNOLOGY OF NANOMATERIALS: Introduction to Nano materials - Basic principles of Nanoscience & Technology – Fabrication of nano materials – Physical & chemical properties of nanomaterials – Carbon nanotubes – Applications of nanotechnology.

TEXT BOOKS :

1. Physics Volume 2 by Halliday, Resnick and Krane; John Wiley & Son.
2. Applied Physics 2nd edition by Dr. P. Appala Naidu & Dr. M. Chandra Shekar, V.G.S. Book links.
3. Engineering Physics by R.K.Gaur & S.L. Gupta; Dhanpat Rai and Sons.

REFERENCES:

1. Nanotechnology by Mark Ratner and Daniel Ratner, Pearson Education.
2. Introduction to solid state physics by C. Kittel; Wiley Eastern Ltd**.**
3. Materials Science and Engineering by V. Raghavan; Prentice-Hall India.
4. Engineering Physics by Dr. M. Arumugam; Anuradha Agencies.
5. Nanomaterials by A.K. Bandyopadhyay; New Age International Publishers.
6. Engineering Physics by M.N. Avadhanulu & P.G. Kshirasagar; S. Chand & Company Ltd.

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I Year B. Tech. AE

T	P	C
3+1*	0	6

ENGINEERING MECHANICS

UNIT – I

Introduction to Engg. Mechanics – Basic Concepts. **Systems of Forces :** Coplanar Concurrent Forces – Components in Space – Resultant – Moment of Force and its Application – Couples and Resultant of Force Systems. **Equilibrium of Systems of Forces :** Free Body Diagrams, Equations of Equilibrium of Coplanar Systems, Spatial Systems for concurrent forces.

UNIT – II

Friction : Types of Friction – Limiting Friction – Laws of Friction – Static and Dynamic Frictions **Motionof Bodies**: Wedge, Screw, Screw-jack, and Differential Screw-jack.

UNIT – III

Transmission of Power: Flat Belt Drives : Types of Flat Belt Drives – Length of Belt, Tensions, Tight side, Slack Side, Initial and Centrifugal Power Transmitted and Condition for Max. Power.

UNIT – IV

Centroid : Centroids of simple figures (from basic principles) – Centroids of Composite Figures **Centre of Gravity :** Centre of gravity of simple body (from basic principles), centre of gravity of composite bodies, Pappus theorem.

UNIT – V

Area moments of Inertia : Definition – Polar Moment of Inertia, Transfer Theorem, Moments of Inertia of Composite Figures, Products of Inertia, Transfer Formula for Product of Inertia. **Mass Moment of Inertia :** Moment of Inertia of Masses, Transfer Formula for Mass Moments of Inertia, mass moment of inertia of composite bodies.

UNIT – VI

Kinematics : Rectilinear and Curvelinear motions – Velocity and Acceleration – Motion of Rigid Body – Types and their Analysis in Planar Motion. **Kinetics :** Analysis as a Particle and Analysis as a Rigid Body in Translation – Central Force Motion – Equations of Plane Motion – Fixed Axis Rotation – Rolling Bodies.

UNIT – VII

Work – Energy Method : Equations for Translation, Work-Energy Applications to Particle Motion, Connected System, Fixed Axis Rotation and Plane Motion, Impulse momentum method.

UNIT – VIII

Mechanical Vibrations : Definitions, Concepts – Simple Harmonic Motion – Free vibrations, simple and Compound Pendulums and its Applications –

TEXT BOOKS :

1. Engineering Mechanics / Fedinand . L. Singer / Harper – Collins.
2. Engg. Mechanics / Timoshenko & Young.
3. Engg. Mechanics / S.S. Bhavikati & J.G. Rajasekharappa

REFERENCES :

1. Engg. Mechanics / Irving. H. Shames Prentice – Hall.
2 Engg. Mechanics Umesh Regl / Tayal.
3 Engg. Mechanics / R.V. Kulkarni & R.D. Askhevkar
4. Engg. Mechanics/Khurmi/S.Chand.
5 Engg. Mechanics / KL Kumar / Tata McGraw Hill.

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T	P	C
3+1*	0	6

NUMERICAL METHODS

UNIT-I
Solutions of Algebraic and Transcendental Equations: Introduction-The Bisection Method-The method of False Position- The Iteration Method- Newton-Raphson Method.

UNIT-II
Interpolation: Introduction –Errors in polynomial Interpolation- Finite differences – Forward Differences- Backward differences –Symbolic relations and separation of symbols- Differences of a polynomial –Newton's formulae for Interpolation- central difference Interpolation formulae-Gauss central Difference Formulae- Interpolation with unevenly spaced points- Lagrange's Interpolation formula.

UNIT-III
Fitting a straight line – Nonlinear curve fitting- curve fitting by a sum of Exponentials- Weighted least squares approximation –Linear weighted least squares approximation- Nonlinear weighted least square.

UNIT-IV
Orthogonal polynomials-Grams Schmidt orthogonalization process- Least-square solution- Representation of B-splines- Computation of B-splines- The Fourier Transform-The Fast Fourier transform.

UNIT-V
Numerical Differentiation and Integration: The cubic Spline method- Trapezoidal rule – Simpson's one-third rule-Simpson's 3/8 rule – Boole's and Weddle's Rules.

UNIT-VI
Matrices and linear systems of Equations: Solution of Linear Systems- Direct Methods –LU Decomposition- LU Decomposition from Gauss Elimination – Solution of Tridiagonal Systems – Solution of Linear Systems.

UNIT-VII
Numerical Solutions of ordinary Differential Equations: Solutions by Taylor's Series –Picard's Method of successive Approximations – Euler's method- Runge-Kutta Methods- Predictor – Corrector Methods – Adams Moulton Method – Milne's Method.

UNIT-VIII
Numerical Solutions of Partial Differential Equations: Introduction- Finite Difference Approximations to Derivatives – Laplace's Equation –Jacobi's Method – Gauss-Seidel Method.

TEXT BOOKS

1. Introductory methods of Numerical Analysis: S.S. Sastry, Prentice Hall of India, Pvt. Ltd.
2. Numerical Methods: Jain, Iyengar.

REFERENCES

1. Numerical Methods: V.N. Vedamurthy, Iyengar N, Ch N Vikas Pub. Reprint 2005.
2. Numerical Methods: S. Arumugam & others, SciTech Pub.
3. Elementary Numerical Analysis: An Algorithm Approach: S.D. Conte and Carl. D.E. Boor, Tata Mc-Graw Hill.

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T	P	C
3+1*	0	6

C PROGRAMMING AND DATA STRUCTURES

UNIT - I

Algorithm / pseudo code, flowchart, program development steps, structure of C program, A Simple C program, identifiers, basic data types and sizes, Constants, variables, arithmetic, relational and logical operators, increment and decrement operators, conditional operator, bit-wise operators, assignment operators, expressions, type conversions, conditional expressions, precedence and order of evaluation.

Input-output statements, statements and blocks, if and switch statements, loops- while, do-while and for statements, break, continue, goto and labels, programming examples.

UNIT - II

Designing structured programs, Functions, basics, parameter passing, storage classes- extern, auto, register, static, scope rules, block structure, user defined functions, standard library functions, recursive functions, header files, C preprocessor, example c programs.

UNIT - III

Arrays- concepts, declaration, definition, accessing elements, storing elements, arrays and functions, two-dimensional and multi-dimensional arrays, applications of arrays. pointers- concepts, initialization of pointer variables, pointers and function arguments, address arithmetic, Character pointers and functions, pointers to pointers, pointers and multidimensional arrays, dynamic memory managements functions, command line arguments, c program examples.

UNIT - IV

Derived types- structures- declaration, definition and initialization of structures, accessing structures, nested structures, arrays of structures, structures and functions, pointers to structures, self referential structures, unions, typedef, bitfields, C program examples.

UNIT - V

Input and output – concept of a file, text files and binary files, streams, standard I/o, Formatted I/o, file I/o operations, error handling, C program examples.

UNIT - VI

Searching – Linear and binary search methods, sorting – Bubble sort, selection sort, Insertion sort, Quick sort, merge sort.

UNIT – VII

Introduction to data structures, singly linked lists, doubly linked lists, circular list, representing stacks and queues in C using arrays and linked lists, infix to post fix conversion, postfix expression evaluation.

UNIT - VIII

Trees- Binary tress, terminology, representation, traversals, graphs- terminology, representation, graph traversals (dfs & bfs)

TEXT BOOKS :

1. Computer science, A structured programming approach using C, B.A. Forouzan and R.F. Gilberg, Third edition, Thomson.
2. DataStructures Using C – A.S.Tanenbaum, Y. Langsam, and M.J. Augenstein, PHI/Pearson education.

REFERENCES :

1. C& Data structures – P. Padmanabham, B.S. Publications.
2. The C Programming Language, B.W. Kernighan, Dennis M.Ritchie, PHI/Pearson Education
3. C Programming with problem solving, J.A. Jones & K. Harrow, dreamtech Press
4. Programming in C – Stephen G. Kochan, III Edition, Pearson Eductaion.
5. Data Structures and Program Design in C, R.Kruse, C.L. Tondo, BP Leung, Shashi M, Second Edition, Pearson Education.

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T	P	C
0	6	8

ENGINEERING GRAPHICS

UNIT – I

INTRODUCTION TO ENGINEERING DRAWING : Principles of Engineering Graphics and their Significance – Drawing Instruments and their Use – Conventions in Drawing – Lettering – BIS Conventions. Curves used in Engineering Practice & their Constructions -Conic Sections including the Rectangular Hyperbola (General method only) - Cycloid, Epicycloid and Hypocycloid - Involute. – Helices – scales used in engineering practice and representive fraction- the principals – construction of plain diagonal and vernier scales

UNIT – II

DRAWING OF PROJECTIONS OR VIEWS ORTHOGRAPHIC PROJECTION IN FIRST ANGLE PROJECTION ONLY : Principles of Orthographic Projections – Conventions – First and Third Angle Projections Projections of Points and Lines inclined to both planes, True lengths, traces.

UNIT – III

PROJECTIONS OF PLANES & SOLIDS : Projections of regular Planes, auxiliary planes and Auxiliary projection inclined to both planes. Projections of Regular Solids inclined to both planes – Auxiliary Views. Sections and Sectional views of Right Regular Solids – Prism, Cylinder, Pyramid, Cone – Auxiliary views.

UNIT – IV

DEVELOPMENT AND INTERPENETRATION OF SOLIDS: Development of Surfaces of Right Regular Solids – Prisms, Cylinder, Pyramid Cone and their parts. Interpenetration of Right Regular Solids – Intersection of Cylinder Vs Cylinder, Cylinder Vs Prism, Cylinder Vs Cone.

UNIT – V

ISOMETRIC PROJECTIONS : Principles of Isometric Projection – Isometric Scale – Isometric Views – Conventions – Isometric Views of Lines, Plane Figures, Simple and Compound Solids – Isometric Projection of objects having non- isometric lines. Isometric Projection of Spherical Parts.

UNIT –VI

TRANSFORMATION OF PROJECTIONS : Conversion of Isometric Views to Orthographic Views – Conventions.

UNIT – VII

PERSPECTIVE PROJECTIONS : Perspective View : Points, Lines, Plane Figures and Simple Solids, Vanishing Point Methods(General Method only).

UNIT – VIII

Introduction to Computer aided Drafting: Generation of points, lines, curves, polygons, simple solids, dimensioning.

TEXT BOOK :

1. Engineering Drawing, N.D. Bhat / Charotar
2. Engineering graphics with Auto CAD- R.B. Choudary/Anuradha Publishes
3. Engineering Drawing, Narayana and Kannaiah / Scietech publishers.

REFERENCES :

1. Engineering Drawing and Graphics, Venugopal / New age.
2. Engineering Drawing- Johle/Tata Macgraw Hill.
3. Computer Aided Engineering Drawing- Trymbaka Murthy- I.K. International.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY
HYDERABAD

I Year B. Tech. AE

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INTRODUCTION TO AEROSPACE ENGINEERING

UNIT I
HISTORICAL EVALUTION
Early airplanes, Multiplanes, biplanes and monoplanes, Developments in aerodynamics, materials, structures and propulsion over the years.

UNIT II
AIRCRAFT CONFIGURATINS
Components of an airplace and their functions. Differrent types of flight vehicles and Classifications, Conventional Control and Powered controls, Basic instruments for flying- Typical systems for actuation.

UNIT III
INTRODUCTION TO PRINCIPLES OF FLIGHT
Physical properties and structure of the atmosphere, Temperature, pressure and altitude relationships, Evolution of lift, drag and moment. Aerofoils, Mach number, Maneuvers.

UNIT IV
INTRODUCTION TO AIRPLANE STRUCTURES
General types of constructions, Monocoque, semi-monocoque and geodesic construction, typical wing and fuselage structure.

UNIT V
POWER PLANTS USED IN AIRPLANES
Basic ideas about piston, turboprop and jet engines, Use of propeller and jets for thrust production, Comparative merits, Principle of operation of rocket, types of rocket and typical application, Exploration into space.

UNIT VI
INTRODUCTION TO AERODYNAMICS
Aerodynamic forces on a wing, free coefficients. Generating lift. Momet coefficients. Center of Pressure, Aerodynamics of wing. Sources of drag.

UNIT VII
AIRCRAFT PERFORMANCE AND STABILITY
Aircraft performance parameters, performance in steady flight, accelerated flight, air planes static stability and dynamic stability – longitudinal stability.

UNIT VIII
SATILLITE SYSTEMS
Satillite missions, an operanational satellite system, elements of satellite. Satellite Structures, Mechanisms and Materials, Power Systems, Communication and Telementy. Thermal Protection system

TEXT BOOKS:

1. Anderson, J.D., “Introduction to Flilght”, McGraw Hill, 1995.
2. Kermode, A.C., “Flight without Formulae”, McGraw Hill, 1987.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

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COMPUTER PROGRAMMING LAB

Objectives:

- To make the student learn a programming language.
- To teach the student to write programs in C solve the problems
- To Introduce the student to simple linear and non linear data structures such as lists, stacks, queues, trees and graphs.

Recommended Systems/Software Requirements:

- Intel based desktop PC
- ANSI C Compiler with Supporting Editors

Week I.

a) Write a C program to find the sum of individual digits of a positive integer.

b) A Fibonacci Sequence is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence. Write a C program to generate the first n terms of the sequence.

c) Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.

Week 2.

a) Write a C program to calculate the following Sum:

Sum=$1-x^2/2! +x^4/4!-x^6/6!+x^8/8!-x^{10}/10!$

b) Write a C program toe find the roots of a quadratic equation.

Week 3

a) Write C programs that use both recursive and non-recursive functions

i) To find the factorial of a given integer.

ii) To find the GCD (greatest common divisor) of two given integers.

iii) To solve Towers of Hanoi problem.

Week 4

a) The total distance travelled by vehicle in 't' seconds is given by distance = $ut+1/2at^2$ where 'u' and 'a' are the initial velocity (m/sec.) and acceleration (m/sec^2). Write C program to find the distance travelled at regular intervals of time given the values of 'u' and 'a'. The program should provide the flexibility to the user to select his own time intervals and repeat the calculations for different values of 'u' and 'a'.

b) Write a C program, which takes two integer operands and one operator form the user, performs the operation and then prints the result. (Consider the operators +,-,*, /, % and use Switch Statement)

Week 5

a) Write a C program to find both the larges and smallest number in a list of integers.

b) Write a C program that uses functions to perform the following:

i) Addition of Two Matrices

ii) Multiplication of Two Matrices

Week 6

a) Write a C program that uses functions to perform the following operations:

i) To insert a sub-string in to given main string from a given position.

ii) To delete n Characters from a given position in a given string.

b) Write a C program to determine if the given string is a palindrome or not

Week 7

a) Write a C program that displays the position or index in the string S where the string T begins, or – 1 if S doesn't contain T.

b) Write a C program to count the lines, words and characters in a given text.

Week 8

a) Write a C program to generate Pascal's triangle.

b) Write a C program to construct a pyramid of numbers.

Week 9

Write a C program to read in two numbers, x and n, and then compute the sum of this geometric progression:

$1+x+x^2+x^3+\ldots\ldots\ldots\ldots+x^n$

For example: if n is 3 and x is 5, then the program computes 1+5+25+125.

Print x, n, the sum

Perform error checking. For example, the formula does not make sense for negative exponents – if n is less than 0. Have your program print an error message if n<0, then go back and read in the next pair of numbers of without computing the sum. Are any values of x also illegal ? If so, test for them too.

Week 10

a) 2's complement of a number is obtained by scanning it from right to left and complementing all the bits after the first appearance of a 1. Thus 2's complement of 11100 is 00100. Write a C program to find the 2's complement of a binary number.

b) Write a C program to convert a Roman numeral to its decimal equivalent.

Week 11

Write a C program that uses functions to perform the following operations:

i) Reading a complex number
ii) Writing a complex number
iii) Addition of two complex numbers
iv) Multiplication of two complex numbers

(Note: represent complex number using a structure.)

Week 12

a) Write a C program which copies one file to another.

b) Write a C program to reverse the first n characters in a file.

(Note: The file name and n are specified on the command line.)

Week 13

Write a C program that uses functions to perform the following operations on singly linked list.:

i) Creation ii) Insertion iii) Deletion iv) Traversal

Week 14

Write a C program that uses functions to perform the following operations on doubly linked list.:

i) Creation ii) Insertion iii) Deletion iv) Traversal in both ways

Week 15

Write C programs that implement stack (its operations) using

i) Arrays ii) Pointers

Week 16

Write C programs that implement Queue (its operations) using

i) Arrays ii) Pointers

Week 17

Write a C program that uses Stack operations to perform the following:

i) Converting infix expression into postfix expression
ii) Evaluating the postfix expression

Week 18

Write a C program that uses functions to perform the following:

i) Creating a Binary Tree of integers
ii) Traversing the above binary tree in preorder, inorder and postorder.

Week 19

Write C programs that use both recursive and non recursive functions to perform the following searching operations for a Key value in a given list of integers :

i) Linear search ii) Binary search

Week 20

Write C programs that implement the following sorting methods to sort a given list of integers in ascending order:

i) Bubble sort ii) Quick sort

Week 21

Write C programs that implement the following sorting methods to sort a given list of integers in ascending order:

i) Insertion sort ii) Merge sort

Week 22

Write C programs to implement the Lagrange interpolation and Newton- Gregory forward interpolation.

Week 23

Write C programs to implement the linear regression and polynomial regression algorithms.

Week 24

Write C programs to implement Trapezoidal and Simpson methods.

Text Books

1. C programming and Data Structures, P. Padmanabham, Third Edition, BS Publications
2. Data Structures: A pseudo code approach with C, second edition R.F. Gilberg and B.A. Forouzan
3. Programming in C, P.Dey & M. Ghosh, Oxford Univ.Press.
4. C and Data Structures, E Balaguruswamy, TMH publications.

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ENGINEERING WORK SHOP PRACTICE

1. TRADES FOR EXERCISES:

1. Carpentry
2. Fitting
3. Tin-Smithy and Development of jobs carried out and soldering.
4. Black Smithy
5. House-wiring
6. Foundry
7. IT Workshop-I : Computer hard ware , identification of parts , Disassembly, Assembly of computer to working condition, Simple diagnostic exercises.
8. IT workshop-II : Installation of Operating system windows and Linux , simple diagnostic exercises.

II TRADES FOR DEMONSTRATION & EXPOSURE:

1. Plumbing
2. Welding
3. Machine Shop
4. Power tools in construction, Wood working, Electrical Engg & Mechanical Engg
5. Metal Cutting (water plasma)

Text Books: Work shop Manual / P.Kannaiah/ K.L.Narayana/ Scitech publishers

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ENGLISH LANGUAGE COMMUNICATION SKILLS LAB

The **Language Lab** focuses on the production and practice of sounds of language and familiarises the students with the use of English in everyday situations and contexts.

Objectives:

1. **To expose the students to a variety of self-instructional, learner-friendly modes of language learning.**
2. **To help the students cultivate the habit of reading passages from the computer monitor, thus providing them with the required facility to face computer-based competitive exams such GRE, TOEFL, GMAT etc.**
3. **To enable them to learn better pronunciation through stress on word accent, intonation, and rhythm.**
4. **To train them to use language effectively to face interviews, group discussions, public speaking.**
5. **To initiate them into greater use of the computer in resume preparation, report writing, format-making etc.**

SYLLABUS :

The following course content is prescribed for the **English Language Laboratory** sessions:

1. Introduction to the Sounds of English- Vowels, Diphthongs & Consonants.
2. Introduction to Stress and Intonation.
3. Situational Dialogues / Role Play.
4. Oral Presentations- Prepared and Extempore.
5. 'Just A Minute' Sessions (JAM).
6. Describing Objects / Situations / People.
7. Information Transfer
8. Debate
9. Telephoning Skills.
10. Giving Directions.

Minimum Requirement:

The English Language Lab shall have two parts:

i) **The Computer aided Language Lab** for 60 students with 60 systems, one master console, LAN facility and English language software for self- study by learners.

ii) **The Communication Skills Lab** with movable chairs and audio-visual aids with a P.A System, a T. V., a digital stereo –audio & video system and camcorder etc.

System Requirement (Hardware component):

Computer network with Lan with minimum 60 multimedia systems with the following specifications:

i) P – IV Processor
   a) Speed – 2.8 GHZ
   b) RAM – 512 MB Minimum
   c) Hard Disk – 80 GB

ii) Headphones of High quality

Suggested Software:

- Cambridge Advanced Learners' English Dictionary with CD.
- The Rosetta Stone English Library
- Clarity Pronunciation Power – Part I
- Mastering English in Vocabulary, Grammar, Spellings, Composition
- Dorling Kindersley series of Grammar, Punctuation, Composition etc.
- Language in Use, Foundation Books Pvt Ltd with CD.
- Oxford Advanced Learner's Compass, 7th Edition
- Learning to Speak English - 4 CDs
- Microsoft Encarta with CD
- Murphy's English Grammar, Cambridge with CD
- English in Mind, Herbert Puchta and Jeff Stranks with Meredith Levy, Cambridge

Books Suggested for English Language Lab Library (to be located within the lab in addition to the CDs of the text book which are loaded on the systems):

1. **Spoken English** (CIEFL) in 3 volumes with 6 cassettes, OUP.
2. **English Pronouncing Dictionary** Daniel Jones Current Edition with CD.
3. **Spoken English**- R. K. Bansal and J. B. Harrison, Orient Longman 2006 Edn.
4. **English Language Communication : A Reader cum Lab Manual** Dr A Ramakrishna Rao, Dr G Natanam & Prof SA Sankaranarayanan, Anuradha Publications, Chennai
5. **Speaking English Effectively** by Krishna Mohan & NP Singh (Macmillan)
6. **A Practical Course in English Pronunciation**, (with two Audio cassettes) by J. Sethi, Kamlesh Sadanand & D.V. Jindal, Prentice-Hall of India Pvt. Ltd., New Delhi.
7. **A text book of English Phonetics for Indian Students** by T.Balasubramanian (Macmillan)

8. **English Skills for Technical Students,** WBSCTE with British Council, OL

DISTRIBUTION AND WEIGHTAGE OF MARKS

English Language Laboratory Practical Paper:

1. The practical examinations for the English Language Laboratory shall be conducted as per the University norms prescribed for the core engineering practical sessions.
2. For the Language lab sessions, there shall be a continuous evaluation during the year for 25 sessional marks and 50 year-end Examination marks. Of the 25 marks, 15 marks shall be awarded for day-to-day work and 10 marks to be awarded by conducting Internal Lab Test(s). The year- end Examination shall be conducted by the teacher concerned with the help of another member of the staff of the same department of the same institution.

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MATHEMATICS – II

UNIT – I

Matrices: Elementary row transformations – Rank – Normal form - Echelon form – Consistency – Solution of system of simultaneous linear homogeneous and non-homogeneous equations.

UNIT – II

Eigen values, Eigen vectors – properties – Cayley-Hamilton Theorem - Inverse and powers of a matrix by Cayley-Hamilton theorem – Diagonolization of matrix. Calculation of powers of matrix – Modal and spectral matrices.

UNIT-III

Real matrices – Symmetric, skew - symmetric, orthogonal, Linear Transformation - Orthogonal Transformation. Complex matrices: Hermitian, Skew-Hermitian and Unitary – Eigen values and Eigen vectors of complex matrices and their properties Quadratic forms- Reduction of quadratic form to canonical form – Rank - Positive, negative definite - semi definite - index - signature - Sylvester law.

UNIT –IV

Fourier Series: Determination of Fourier coefficients – Fourier series – even and odd functions – Fourier series in an arbitrary interval – even and odd periodic continuation – Half-range Fourier sine and cosine expansions.

UNIT-V

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – solutions of first order linear (Lagrange) equation and nonlinear (standard type) equations.

UNIT –VI

Method of separation of variables – Classification of second order linear Partial Differential Equations, solutions of one dimensional heat equation, wave equation and two-dimensional Laplace's equation under initial and boundary conditions.

UNIT –VII

Fourier integral theorem – Fourier sine and cosine integrals. Fourier transforms – Fourier sine and cosine transforms – properties – inverse transforms – Finite Fourier transforms.

UNIT-VIII

Z-transform – inverse z-transform - properties – Damping rule – Shifting rule – Initial and final value theorems. Convolution theorem – Solution of difference equation by z-transforms.

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Text Books:

1. A text Book of Engineering Mathematics, Vol-II T. K. V. Iyengar, B. Krishna Gandhi and Others, S. Chand & Company.
2. A text Book of Engineering Mathematics, C. Sankaraiah, V. G. S. Book Links.
3. A text Book of Engineering Mathematics, Shahnaz Bathul, Right Publishers.
4. A text Book of Engineering Mathematics, P. Nageshwara Rao, Y. Narasimhulu & N. Prabhakar Rao, Deepthi Publications.

References:

1. A text Book of Engineering Mathematics, B. V. Raman, Tata Mc Graw Hill.
2. Advanced Engineering Mathematics, Irvin Kreyszig, Wiley India Pvt. Ltd.
3. A text Book of Engineering Mathematics, Thamson Book Collection.

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THERMODYNAMICS

Tables/Codes: Steam Tables and Mollier Chart, Refrigeration Tables should be supplied

UNIT – I
System, Control Volume, Surrounding, Boundaries, Universe, Types of Systems, Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic Equilibrium, State, Property, Process, Cycle – Reversibility – Quasi – static Process, Irreversible Process, Causes of Irreversibility – Energy in State and in Transition, Types, Work and Heat, Point and Path function.

UNIT II
Zeroth Law of Thermodynamics – Concept of quality of Temperature – Principles of Thermometry – Reference Points – Const. Volume gas Thermometer – Scales of Temperature, Ideal Gas Scale – PMM I - Joule's Experiments – First law of Thermodynamics – Corollaries – First law applied to a Process – applied to a flow system – Steady Flow Energy Equation.

UNIT – III
Limitations of the First Law – Thermal Reservoir, Heat Engine, Heat pump , Parameters of performance, Second Law of Thermodynamics, Kelvin-Planck and Clausius Statements and their Equivalence / Corollaries, PMM of Second kind, Carnot's principle, Carnot cycle and its specialties, Thermodynamic scale of Temperature, Clausius Inequality, Entropy, Principle of Entropy Increase – Energy Equation, Availability and Irreversibility – Thermodynamic Potentials, Gibbs and Helmholtz Functions, Maxwell Relations – Elementary Treatment of the Third Law of Thermodynamics.

UNIT IV
Pure Substances, p-V-T- surfaces, T-S and h-s diagrams, Mollier Charts, Phase Transformations – Triple point at critical state properties during change of phase, Dryness Fraction – Clausius – Clapeyron Equation Property tables. Mollier charts – Various Thermodynamic processes and energy Transfer – Steam Calorimetry.

UNIT - V
Perfect Gas Laws – Equation of State, specific and Universal Gas constants – various Non-flow processes, properties, end states, Heat and Work Transfer, changes in Internal Energy – Throttling and Free Expansion Processes – Flow processes – Deviations from perfect Gas Model – Vander Waals Equation of State – Compressibility charts – variable specific Heats – Gas Tables

UNIT – VI
Mixtures of perfect Gases – Mole Fraction, Mass friction Gravimetric and volumetric Analysis – Dalton's Law of partial pressure, Avogadro's Laws of additive volumes – Mole fraction , Volume fraction and partial pressure, Equivalent Gas const. And Molecular Internal Energy, Enthalpy, sp. Heats and Entropy of Mixture of perfect Gases and Vapour, Atmospheric air - Psychrometric Properties – Dry bulb Temperature, Wet Bulb Temperature, Dew point Temperature, Thermodynamic Wet Bulb Temperature, Specific Humidity, Relative Humidity, saturated Air, Vapour pressure, Degree of saturation – Adiabatic Saturation , Carrier's Equation – Psychrometric chart.

UNIT - VII
POWER CYCLES
Otto, Diesel, Dual Combustion cycles, Sterling Cycle, Atkinson Cycle, Ericcson Cycle, Lenoir Cycle – Description and representation on P–V and T-S diagram, Thermal Efficiency, Mean Effective Pressures on Air standard basis – comparison of Cycles.

UNIT VIII
REFRIGERATION CYCLES
Brayton and Rankine cycles – Performance Evaluation – combined cycles, Bell- Coleman cycle, Vapour compression cycle-performance Evaluation.

TEXT BOOKS :
Engineering Thermodynamics / PK Nag /TMH, III Edition

REFERENCES:
1. Fundamentals of Classical Thermodynamics – G. Van Wylan & R.E. Sonntag – John Wiley Pub.
2. Engineering Thermodynamics – Jones & Dugan
3. Thermodynamics – An Engineering Approach – Yunus Cengel & Boles /TMH
4. Thermodynamics – J.P.Holman / McGrawHill
5. An introduction to Thermodynamics / YVC Rao / New Age

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FOUNDATIONS OF SOLID MECHANICS

UNIT I
AXIAL FORCES AND TORQUES:
Introduction to concepts of stress, strain, strain energy density at a point and Hookes law, Stress strain diagrams, resilience, elastic limit, yield point, elastic moduli and analysis of axially loaded prismatic bars. Determination of axial load diagrams. Deflections and stresses in determinate and indeterminate uniform / non –uniform / composite prismatic bars subjected to distributed & concentrated loads.

Determination torque diagrams deflections and stresses in uniform / non-uniform / composite circular cylindrical bars subjected to distributed & concentrated torsional loads.

UNIT – II
SHEAR FORCE AND BENDING MOMENT DIAGRAMS:
Definition of beam – Types of beams – Concept and conventions of shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, u.d.l., uniformly varying loads and their combinations – Relations among distributed load (loading), S.F and B.M diagrams and use of singularity methods.

UNIT – III
FLEXURAL STRESSES:
Theory of simple bending – Assumptions – Derivation of bending equation: M/I = f/y = E/R Neutral axis – Determination bending stresses – section modulus of rectangular and circular sections (Solid and Hollow), I,T, Angle and Channel sections –. Stress in Composite beams using equivalent width concepts and its limitations.

UNIT – IV
SHEAR STRESSES:
Derivation, formula for Shear stress distribution across various beam sections like rectangular, circular, triangular, T, Angle sections and I.

UNIT – V
DEFLECTION OF DETERMINATE BEAMS:
Assumptions of elementary theory of bending – slope, deflection and radius of curvature – Differential equation for the elastic axis of a beam – Double integration and McCauley's methods. Determination of slope and deflection for cantilever and simply supported beams subjected to point loads, - U.D.L, Uniformly varying load. Singularity method of deflection analysis.

UNIT VI
CYLINDRICAL SHELLS
Thin Seamless cylindrical shells – derivation of formulae for longitudinal and circumferential stresses, Hoop, Longitudinal and volumetric Strain, changes in diameter and volume of thin cylinders and thin spherical shells.

UNIT VII
MODES OF JOINT FAILURE
Stresses in joints including riveted bolted and welded joint. Failure analysis of various joints. Load flow diagrams in riveted (Lap and Butt) joints with or without friction.

UNIT - VIII
UNSYMMETRIC BENDING
Stress analysis of isotropic, composite unsymmetrical beams.

TEXT BOOKS:

1. Strength of Materials by Byars, EF. Snyder R.D. and plants H. L., 4th Edition Harper Row 0Publishers, 1983.
2. Mechanics of Materials by Gere J. M, and Timoshemko S. P. CBS Publishers.
3. Mechanics of Materials by Beer Johanson Dewaf TMH 3rd Edition 2004.

REFERENCES:

1. Strength of Materials by Andrew Pytel and Ferdinond L. Singer Longman.
2. Strength of Materials by Nash W. Asian Student Edition, Harper Row Publishers.
3. Mechanics of Materials Popov E. P, Nagarajan S. and Lu z. A, S. I Version 2nd Edition Printice Hall of India PVT. New Delhi.

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MECHANICS OF FLUIDS

UNIT – I

Fluid Properties And Fluid Statics: Density, Specific weight, Specific gravity, viscosity, Vapour pressure, compressibility, Pressure at a point, Pascal's law, pressure variation with temperature, density and attitude. Hydro static law, Piezometer, Simple and differential manometers, pressure gauges, total pressure and center of pressure – plane, vertical and inclined surfaces. Buoyancy and stability of floating bodies.

UNIT – II

Fluid Kinematics : Stream line, path line, streak line, stream tube, classification of flows, steady, unsteady, uniform, non-uniform, laminar, turbulent, rotational, irrotational flows, one, two and three dimensional flows – Continuity equation in 3D flow, stream function, velocity potential function.

UNIT – III

Fluid Dynamics : Surface and Body forces – Euler's and Bernoulli's equation derivation, Navierstokes equation (explanation only) Momentum equation - applications, vortex – Free and Forced. Forced vortex with free surface.

UNIT – IV

Similitude and Flow Measurement – Similarly laws, distorted models. Flow through Venturimeter and Orificemeter, flow through notches and weirs, Viscometers, Hot wire Anemometers, Pitot tube, Flow through nozzles.

UNIT – V

Approximate solutions of N.S. Equations - Boundary layer- concepts, Prandtl contribution,Characteristices of boundary layer along a thin flat plate Von-karman's momentum integral equation (No derivation), laminar and turbulent Boundary layers,BL in transition,separation of BL,control of BL separation,flow around submerged objects, Drag and lift – types of drag – magnus effect.

UNIT – VI

Closed Conduit Flow: Characteristics of real fluids – Reynolds experiment –Darcy's equation, Minor losses – pipes in series – pipes in parallel – Total energy line and hydraulic gradient line.

UNIT VII

Exact Solutions of Navier Stokes Equations. Flow between parallel plates, flow through long tubes - Fow through inclined tubes, Turbulent flow, variation of friction factor with Reynold's Number
– Mody's chart.

UNIT VIII

Flow of Compressible Fluid: Introduction, Thermodynamic relations, basic equations of compressible flow, velocity of sound wave in a fluid for isothermal and adiabatic process, mach number and its applications, mach angle, Propagation of Pressure waves and stagnation properties

TEXT BOOKS:

1. Fluid Mechanics Hydraulics and Hydraulics Machines Modi & Seth, Standard publications, New Delhi.
2. Engineering Fluid Mechanics by K.L.Kumar, S.Chand & Co.

REFERENCES :

1. Fluid Mechanics – Frank in white Mc-Grawhill.
2. Fluid Mechanics - John – F.Dauglas, Pearson Educations publishers.
3. Fluid Mechanics & Hydraulic Machines - D. Ramadurgaiah, Newage Publishers.

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AIRCRAFT ENGINEERING DRAWING

UNIT :I

Machine Drawing conventions. Need for Drawings conventions – Introduction to ISI- Conventions

a) Conventional representation of materials , common machine elements and parts such as screws,nuts,bolts,keys,gears,webs,ribs
b) Types of sections – Selection of sectional planes and drawing of sections and auxiliary sectional views. Parts not usually sectioned
c) Methods of dimensioning , general rules for sizes and placement of dimensions for holes ,centers, curved and Tapered features
d) Title boxes, their size, location and details –common abbreviations and their liberal usage.
e) Types of drawing – working drawing for machine parts

UNIT : II

Drawing of Machine Elements and simple parts .Section of views , additional views for the following machine elements and parts with every drawing proportions

a) Popular forms of screw threads, bolts, set screws and bolted joints.
b) Keys,cottered joint and knuckle joint
c) Riveted joints for plates.
d) Shaft couplings, spigot and socket pipe joint.
e) Journal, pivot, collar and foot step bearing
f) Welded joints and welding symbols.

UNIT : III

Following simple Air Craft assembly drawings only.

a) Different types of trusses used in wings fuselage including ribs, striengers,skin,brakets
b) Different elements of fuselage structures ,bulk head , rings (frame) long irons
c) Different types of fuselage.
d) landing gear basic elements ,structural brackets ,wheel, shock absorber and Hydraulic cylinder
e) connecting rod for aero piston engine

Text Books:

1. Machine drawing by N.D. Baht / V.M. Panchal / Charotar Publication House – 2000 Ed .
2. Air Craft structures BY TMH Megson

REFERENCES:

1. Machine Drawing by K.L.Narayana, P.Kannaiah and K.Venkata Reddy / New Age Publishers.
2. Air Craft structures by Bruhn.E.H
3. Machine Drawing by P.S.Gill
4. Machine Drawing by Luzzader
5. Machine Drawing by Rajput.

Equipment Needed

1. Hardware assembly models relevant to above are needed for demonstration
2. Drawing Boards with Mini drafting machines, 60 required for strength of 60 capacity .

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ENVIRONMENTAL STUDIES

UNIT - I

Multidisciplinary nature of Environmental Studies: Definition, Scope and Importance – Need for Public Awareness.

UNIT - II

Natural Resources : Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems - Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. - Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. - Energy resources: Growing energy needs, renewable and non-renewable energy sources use of alternate energy sources. Case studies. Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

UNIT - III

Ecosystems : Concept of an ecosystem. - Structure and function of an ecosystem. - Producers, consumers and decomposers. - Energy flow in the ecosystem - Ecological succession. - Food chains, food webs and ecological pyramids. - Introduction, types, characteristic features, structure and function of the following ecosystem:

a. Forest ecosystem
b. Grassland ecosystem
c. Desert ecosystem
d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

UNIT - IV

Biodiversity and its conservation : Introduction - Definition: genetic, species and ecosystem diversity. - Bio-geographical classification of India - Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values - . Biodiversity at global, National and local levels. - . India as a mega-diversity nation - Hot-sports of biodiversity - Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. - Endangered and endemic species of India - Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT - V

Environmental Pollution : Definition, Cause, effects and control measures of :

a. Air pollution
b. Water pollution
c. Soil pollution
d. Marine pollution
e. Noise pollution
f. Thermal pollution
g. Nuclear hazards

Solid waste Management : Causes, effects and control measures of urban and industrial wastes. - Role of an individual in prevention of pollution. - Pollution case studies. - Disaster management: floods, earthquake, cyclone and landslides.

UNIT - VI

Social Issues and the Environment : From Unsustainable to Sustainable development -Urban problems related to energy -Water conservation, rain water harvesting, watershed management -Resettlement and rehabilitation of people; its problems and concerns. Case Studies -Environmental ethics: Issues and possible solutions. -Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies. -Wasteland reclamation. –Consumerism and waste products. -Environment Protection Act. -Air (Prevention and Control of Pollution) Act. -Water (Prevention and control of Pollution) Act -Wildlife Protection Act -Forest Conservation Act -Issues involved in enforcement of environmental legislation. -Public awareness.

UNIT - VII

Human Population and the Environment : Population growth, variation among nations. Population explosion - Family Welfare Programme. -Environment and human health. -Human Rights. -Value Education. -HIV/AIDS. -Women and Child Welfare. - Role of information Technology in Environment and human health. -Case Studies.

UNIT - VIII

Field work : Visit to a local area to document environmental assets River /forest grassland/hill/mountain -Visit to a local polluted site-Urban/Rural/industrial/ Agricultural Study of common plants, insects, birds. -Study of simple ecosystemspond, river, hill slopes, etc.

TEXT BOOK:

1. Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission.
2. Environmental Studies by R. Rajagopalan, Oxford University Press.

REFERENCE:

1 Textbook of Environmental Sciences and Technology by M. Anji Reddy, BS Publication.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY
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II Year B. Tech. AE – II semester	**T**	**P**	**C**
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CAD LAB

1. Fundamentals of CAD and Design process
2. Geometric Modeling
   - 2D Drawings: points, lines, curves, and planes
   - 3D Drawings: Solids (Boolean operations)
   - Part Drawings and Dimensioning
   - Part modeling through 2D, 3D modeling techniques.
3. Solid and Surface Modeling
   - 2D Drawing:
   - 3D Drawing:
   - Part Drawing and Dimensioning from Aircraft Drawing
   - Part modeling from Aircraft Components
   - Solid and surface modeling.

TEXT BOOKS

1. Mikell, P., Groover, CAD / CAM Prentice Hall of India
2. Ibrahim Zeid, “CAD/CAM Theory and Practice”; Prentice Hall of India

REFERENCES

1. CAD/CAM By P.N.Rao.

Equipment needed

1. Computers with P-IV systems, 256 MB RAM with NT or Windows server 60 nos / 60 students batch
2. Multiple licensed software with 60 licenses for batch of 60 students.
   Minimum Auto CAD 2007.
   One of the following latest versions is Desirable
   CATIA V-5 or Pro-E or Solid Works

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MECHANICS OF SOLIDS AND MECHANICS OF FLUIDS LAB

MECHANICS OF SOLIDS LAB

1. Direct tension test
2. Bending test on
    a) Simple supported
    b) Cantilever beam
3. Torsion test
4. Hardness test
    a) Brinells hardness test
    b) Rockwell hardness test
5. Test on springs
6. Compression test on cube
7. Impact test
8. Punch shear test

MECHANICS OF FLUIDS LAB

1. Calibration of Venturimeter
2. Calibration of Orifice meter
3. Determination of Coefficient of discharge for a small orifice by a constant head method.
4. Determination of Coefficient of discharge for an external mouthpiece by variable head method.
5. Calibration of contracted Rectangular Notch
6. Calibration of contracted Triangular Notch
7. Determination of Coefficient of loss of head in a sudden contraction and friction factor.
8. Verification of Bernoulli's equation.

Equipment needed

MOS – lab

1. UTM – 20 / 40 Tons with load Vs Elongation graphical attachment and provision for Bending and sheering along with accessories and end grips
2. Deflection test rig (Fabricated hardware + precession dial gauge)
3. Torsion testing Machine
4. Hardness testing Machine (Brinnel and Rockwell)
5. Impact Testing Machine
6. Spring testing Machine.

MOF – lab

1 Venturimeter test rig
2.Test rig for Flow over notch
3.Pipe friction apparatus
4.Bernoulli's apparatus
5.test rig for Orifice meter
6. Mouthpiece apparatus.

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MATHEMATICS FOR AEROSPACE ENGINEERS

UNIT -I
SPECIAL FUNCTIONS: Gamma and beta functions and their properties. Evaluation of improper integrals. Bessel functions – Properties – Recurrence relations. Orthogonality of Bessel functions. Legendre functions –Legendra Polynomials- properties-recurrence relations. Orthogonality of Legendre polynomials- Rodrigue's formula

UNIT- II
Functions of a complex variable –continuity-differentiability –analyticity- properties of analytic functions.m Cauchy – Riemann equations in Cartesian and polar co- ordinates .Harmonic and conjugate harmonic functions. Milne – Thomson method, complex integration.

UNIT- III
Line integral – evaluation along a path and by indefinite integration – Cauchy integral theorem- Cauchy integral formula. Generalized integral formula- zero- singular point- isolated singular point – pole of order, m – essential singularity

UNIT- IV
Complex power series: radius of convergence – Expansion in Taylor's series , Maclaurins series and Laurent's series. Residue: Evaluation of residue by formula and by Laurent series – Residue theorem –Evaluation of Integrals of type ? f(cos , sin) d , ?f(x) dx ,?eimx f(x) dx; Argument principle- Rouche's theorem – fundamental theorem of algebra. Liou ville's theorem

UNIT- V:
Conformal mapping, Transformation by ez , log e z z n , sinz ,cosz , z+ n/z . Bilinear transformation – fixed point, cross ratio, properties, invariance of cross ratio under bilinear transformation. Determination of bilinear transformation mapping 3 given points.

UNIT- VI
Tensor analysis: Introduction to tensor analysis. Summation to convention- co –variant and contravariant tensors- Fundamental and reciprocal tensors and christoffel symbols.

UNIT-VII
STATISTICS: Sample space and events – probability, the axioms of probability –some elementary theorems- conditional probability- Baye's theorem

UNIT - VIII
Introduction to random variables – discrete and continuous- discontinuous functions. Binomial, Poisson and normal distributions and related properties, mean, standard deviation, auto and cross correlations.

TEXT BOOKS:
1. A text book of engineering mathematics vol iv-2004 by T.K.Iyengar, B.Krishna Gandhi & Others, S.Chand and company.
2. Engineering Mathematics – B.V.Ramana BY Tata Mc-Grawhill.

REFERENCES:
1. Fundamentals of Mathematical statistics by S.C. Gupta and VK Kapoor.
2. Brog .S.F. Matrix – Tensor methods in Continuum Mechanics- D- VAN Nostrand company.

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	4+1*	**0**	**4**

AERODYNAMICS – I

UNIT-I - BASICS
Wing and Airfoil section geometry - Aerodynamic forces and moments-Force and moment components and coefficients, Pressure distribution on an airfoil, Types of drag, Estimation of lift, Drag and pitching moment coefficient from the pressure distribution. Experimental methods, wake survey.

UNIT-II - ELEMENTARY FLOWS
Incompressible flow condition, Governing equation for irrotational, incompressible flow: Laplace's equation, Boundary conditions. Elementary flows. Combination of uniform flow with a Source and Sink, Doublet. Flow over a circular cylinder, Vortex flow. Circulation, Kutta-Joukowski theorem. Lifting flow over a cylinder The vortex sheet. Kelvin circulation theorem and starting vortex.

UNIT-III - INCOMPRESSIBLE FLOW OVER AIRFOILS
The complex potential function and conformal transformation, The Kutta-Zhukovsky transformation. Kutta condition. Lift on the Zhukovsky airfoil section.

UNIT-IV - THIN AIRFOIL THEORY
Classical thin airfoil theory for symmetric and cambered airfoil sections. Comparison of theoretical and experimental results. Limitations of thin airfoil theory.

UNIT-V - INCOMPRESSIBLE FLOW OVER FINITE WINGS
Vortex filament, Biot-Savart law and Helmholtz's theorems, Prandtls classical lifting line theory: Downwash and induced drag. Elliptical and modified elliptical lift distribution. Lift distribution on wings. Limitations of Prandtl's lifting line theory.

UNIT-VI - EXTENDED LIFTING LINE THEORY
Extended lifting line theory- lifting surface theory, vortex lattice method for wings. Lift, drag and moment characteristics of complete airplane.

UNIT-VII - SOURCE PANEL METHOD
Source panel method-non-lifting flow over an arbitrary bodies-potential flow over a circular cylinder.

UNIT-VIII - VORTEX PANEL METHOD
Vortex panel methods-Lifting flow over an arbitrary body- flow over a symmetrical airfoil

TEXT BOOKS
1. Anderson, J .D., Fundamental of Aerodynamics, Mc Graw-Hill International Edition
2. Houghton, E.L., and Carruthers, N.B., Aerodynamics for Engineering Students, Edward Arnold Publishers Ltd., London, 1989

REFERENCES :
1. Clancy, L.J., Aerodynamics, Pitman, 1986
2. Milne Thomson, Theoretical Aerodynamics, Macmillan, 1985

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AIRCRAFT PRODUCTION TECHNOLOGY

UNIT – I
INTRODUCTION
Classification and comparision (merits and limitations) of manufacturing process, criterion for selection of a process
General principles of various Casting Processes - Sand casting, die-casting, centrifugal casting, investment casting, shell moulding types

UNIT -
WELDING And Bonding Techniques
Principles and equipment used in arc welding, gas welding, resistance welding, thermit welding, recent advances in welding technology, Soldering and brazing techniques.

UNIT - III
MACHINING
General principals (with schematic diagram only) of working and types-lathe, shaper, milling machines, grinding, drilling m/c, CNC machining and general principles.

UNIT - IV
SHEET METAL FORMING
Sheet metal operations-shearing, punching, dropstamp forming, Advanced metal forming (super plastic forming and diffusion bonding). Bend correction for bending in single plane, Automation in bend forming and different operations in bending like stretch forming spinning drawing etc.

UNIT- V
UNCONVENTIONAL MACHINING
Principles (with schematic diagram only) of working and applications of abrasive jet machining, ultrasonic machining, electric discharge machining, electro chemical machining, laser beam/electron beam/plasma arc machining

UNIT-VI
HEAT TREATMENT AND SURFACE FINISHING
Heat treatment of Aluminium alloys, titanium alloys, steels, case hardening, Initial stresses and the stress alleviation procedures. Corrosion prevention, protective treatment for aluminium alloys, steels, anodizing of titanium alloys, organic coating, and thermal spray coatings. Grinding and Polishing, Technology of surface finish.

UNIT - VII
AIRCRAFT ASSEMBLY
Aircraft Tooling Concepts, Jigs, fixtures, stages of assembly, types and equipment for riveted joints, bolted joints (only).

UNIT - VIII
QUALITY CONTROL AND ASSURANCE
Concepts and definitions of quality, reliability, quality circles, zero defect program: international standards, six-sigma quality.
NDT AND OTHER INSPECTION TECHNIQUES
Dye Penetrant Test, X - ray, magnetic particle and ultrasonic testing. Accoustic holography.

TEXTBOOKS:
1. “Air craft production techniques” Keshu S.C, Ganapathy K.K., Interline Publishing House, Banglore-1993
2. “Manufacturing Engineering and Technology” by Kalpakajam – Addison Wesley.

REFERENCES:
1. “Production technology”- R.K. Jain – Khanna Publishers – 2002.
2. “Production technology”-O.P.Khanna and lal. M.Dhanpat rai publications-New Delhi-1997

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ELECTRICAL AND ELECTRONICS ENGINEERING

UNIT-I - ELECTRICAL CIRCUITS
Basic definitions, Types of elements, Ohm's Law, Resistive networks, Kirchhoff's Laws, Inductive networks, capacitive networks, Series, Parallel circuits and Stardelta and delta-star transformations.

UNIT II - DC MACHINES
Principle of operation of DC Generator – emf equation - types – DC motor types – torque equation – applications – threee point starter.

UNIT III - TRANSFORMERS
Principle of operation of single phase transformers – emf equation – losses – efficiency and regulation

UNIT IV - AC MACHINES
Principle of operation of alternators – regulation by synchronous impedance method – Principle of operation of induction motor – slip – torque characteristics – applications.

UNIT V - INSTRUMENTS
Basic Principle of indicating instruments – permanent magnet moving coil and moving iron instruments.

UNIT VI - DIODE AND IT'S CHARACTERISTICS
P-n junction diode, symbol, V-I Chacracteristics, Diode Applications, Rectifiers – Half wave, Full wave and Bridge rectifiers (simple Problems)

UNIT VII - TRANSISTORS
PNP and NPN Junction transistor, Transistor as an amplifier, SCR characteristics and applications

UNIT VIII - CATHODE RAY OSCILLOSCOPE
Principles of CRT (Cathode Ray Tube), Deflection, Sensitivity, Electrostatic and Magnetic deflection, Applications of CRO - Voltage, Current and frequency measurements.

TEXT BOOKS:
1. Essentials of Electrical and Computer Engineering by David V. Kerns, JR. J. David Irwin
2. Principles of Electrical and Electronics Engineering by V.K.Mehta, S.Chand & Co.

REFERENCES:
1. Introduction to Electrical Engineering – M.S Naidu and S. Kamakshaiah, TMH Publ.
2. Basic Electrical Engineering by Kothari and Nagarath, TMH Publications, 2nd Edition.

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AEROSPACE MATERIALS AND COMPOSITES

UNIT-I

Mechanical behavior of engineering materials, linear and non-linear elastic properties, yielding, strain hardening, fracture Barochinger's effect, notch effect, testing and flow detection of materials including super alloys and P-H. steels. Thermo-Structural behavior of materials for application at elevated temperatures.

UNIT-II

Introduction, wrought, cast and forged aluminum alloys, production of semi-fabricated forms for aerospace applications.

UNIT-III

Introduction to composites:

Classification characterization, advantages and applications of composite materials – Reinforcements and matrices, composite structures. Single layer symmetric, Anti-symmetric and un-symmetric lay up configurations with cross – ply and angle – ply lay – ups. Introduction to 3D composites, filament wound and Woven composites.

UNIT-IV

Charaterization of Composites

Stress strain relations of composites, Otrhotropic behavior of composites, Mechanics of Materials approach to determine Young's modulus, Shear modulus and Poisson's ratio, Stress strain relations in material coordinates, strength concepts, Biaxial strength theories, maximum stress, maximum strain, fracture toughness of composites

UNIT-V

Lamination of CCA models and introduction to micro mechanics. Elasticity based micro-mechanical models, introduction to FEM in composites characterization.

UNIT-VI

Open and closed mould process, filament winding, pull-trusion and online production methods of manufacture of fibers and composites. Manufacture of high performance composite materials applicable in elevated temperature field.

UNIT-VII

Introduction to impact damage of composite life production and damage tolerance studies, fracture toughness of composites. NDT techniques for quality assurance.

UNIT-VIII

Environmental and Manufacturing considerations in selection of materials for Aircrafts, Rockets. Materials used for Aircraft applications – application of composite materials, super alloys for supersonic vehicles.

TEXT BOOKS:

1. "Analysis and performance of fibre composites ", Agarwal B. D., Broutman. L. J., John Wiley and sons – New york, 1980.
2. Hand Book on "Advanced Plastics and fibre glass " , Lubin. G, Von. Nostrand, Reinhold Co. New york, 1989.
3. "Advanced Composite Materials" Lalith Gupta, Himalayan book, New Delhi, 1998.
4. " Mechanics of Composite Materials" Jones R.M. McGrawHill Kogakusha, ltd. Tokyo.

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	4+1*	**0**	**4**

MECHANISMS AND MECHANICAL DESIGN

UNIT - I
MECHANISMS
Elements of links – Classification – Rigid link, flexible and fluid link – Types of kinematic pairs – Sliding, turning, rolling, screw and spherical pairs – Lower ad higher pairs – Closed and open pairs – Constrained motion – Completely, partially or successfully constrained and incompletely constrained.
MACHINES
Mechanism and machines – Classification of machines – Kinematic chain – Inversion of mechanism – Inversion of quadratic cycle, Chain – single and double slider crank chains. Exact and approximate Straight line Mechanisms - Peaucellier, Hart T. Chebibheff , Pantograph.

UNIT – II
KINEMATICS
Velocity and acceleration – Motion of link in machine – Determination of velocity and acceleration diagrams – Graphical method – Application of relative velocity method four bar chain.
ANALYSIS OF MECHANISMS
Analysis of slider crank chain for displacement, Velocity and acceleration of sliding – Acceleration diagram for a given mechanism, Kleins construction, Coriolis acceleration, Determination of Coriolis component of acceleration.

UNIT – III
PLANE MOTION OF BODY
Instantaneous center of rotation, centroids and axodes – Relative motion between two bodies – Three centers in line theorem – Graphical determination of instantaneous center, diagrams for simple mechanisms and determination of angular velocity of points and links.

UNIT – IV
Precission: Effect of Precission on Stability of moving vehicles such as motorcar motorcycle Aero planes and ships. Static and Dynamic forces generated due to in Precission in moving mechanisms including Gyroscopic motions.

UNIT – V
CAMS
Definition of cam and followers – Their uses – Types of followers and cams – Terminology – Types of follower motion – Uniform velocity – Simple harmonic motion and uniform acceleration. Maximum velocity and Maximum acceleration during out ward and return strokes in all the above three cases.

UNIT – VI
ANALYSIS OF MOTION OF FOLLOWERS
Roller follower – Circular cam with straight, concave and convex flanks.

UNIT – VII
DESIGN OF MACHINE ELEMENTS
Principles of mechanical design- dimensional tolerances, fits. Design of common machine elements Springs, shafts, couplings, Universal coupling.

UNIT – VIII
GEARS AND GEAR TRAINS
Introduction to gears-types, Law of gearing, Tooth profiles, specifications, classification-Helical, Bevel and worm gears: Simple and reverted gear train, epicyclic gear trains-velocity ratio or train value

TEXT BOOKS
1. Theory of Machines, Dr Jagdish Lal, JM Shaw, 2003
2. Theory of Machines, PL Ballaney, Khanna Publishers, 2003.

REFERENCES
1. Theory of Mechanisms and machines, Amithab Ghosh and Asok Kumar Malik, East West Press Private Limited – 2001.
2. Theory of Machines, Abdulla Sharif, Dhanpat Rai, 1987.
3. Mechanism and Machine Theory, JS Rao and RV Dukkipati / New Age – 1996.
4. Theory of Machines Through Solved Problems, JS Rao / New Age – 1996.
5. Machine Design Pandya & Sha - Charotar Publication House – 1997.
6. Mechanical Engineering and Design, J.E.Shigley and Charles.R.Mischke, TMH, 2003.

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	0	**3**	**2**

AIRCRAFT MATERIALS AND PRODUCTION LAB

Basic Exercises in Lathe, Shaper, Milling, Slotting, EDM, CNC and Grinding machines welding equipment and metallurgy equipment comprising Microscopes polishing disc grinders as under.

PRODUCTION LAB

1. Plain Turning, Taper turning, Facing, Knurling, Thread Cutting.
2. Drilling, boring, counter boring, counter sinking
3. Shaping and planning of square blocks, V-ways and Dovetail ways
4. Plain Milling
5. Gear Milling
6. Cylindrical Grinding / Surface Grinding
7. Simple exercises in EDM
8. Sheet metal joining by rivets, Soldering and brazing.
9. Simple exercises on CNC machines and Programme generation.
10. Simple exercises in Solid State Welding, Gas Welding and Arc Welding.
11. Metal joining Techniques (Brazing and Soldering).

MATERIALS LAB

12. Aircraft wood gluing practice
13. Study of properties of sandwich structures
14. Study of Micro Structures of Non ferrous alloys
15. Experiment on Autoclave for different geometrical structures

Reference:

1. “Air craft production techniques” Keshu S.C, Ganapathy K.K., Interline Publishing House, Banglore-1993
2. “Manufacturing Engineering and Technology” by Kalpakajam – Addison Wesley.

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ELECTRICAL AND ELECTRONICS ENGINEERING LAB

Section A: Electrical Engineering

The following experiments are required to be conducted as compulsory experiments :

1. Swinburne's test on D.C. Shunt machine. (Predetermination of efficiency of a given D.C. Shunt machine working as motor and generator).
2. OC and SC tests on single phase transformer (Predetermination of efficiecy and regulation at given power factors)
3. Brake test on 3-phase Induction motor (Determination of performance characteristics)
4. Regulation of alternator by Synchronous impedance method. In addition to the above four experiments, any one of the experiments from the following list is required to be conducted :
5. Speed control of D.C. Shunt motor by
    a. Armature Voltage control motor
    b. Field flux control method
6. Brake test on D.C Shunt Motor

Section B: Electronics Engineering

1. Transistor CE Characteristics (Input and Output)
2. Full wave Rectifier with and without filters.
3. CE Amplifiers.
4. RC Phase Shift Oscillator
5. Class A Power Amplifier
6. Micro Processor

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MANAGEMENT SCIENCE

Unit I: ***Introduction to Management*****:** Concepts of Management and organization- Nature and Importance of Management, Functions of Management, Taylor's Scientific Management Theory, Fayol's Principles of Management, Maslow's Theory of Human Needs, Douglas McGregor's Theory X and Theory Y, Herzberg's Two-Factor Theory of Motivation, Systems Approach to Management, Leadership Styles, Social responsibilities of Management.

Unit II: ***Designing Organisational Structures*****:** Basic concepts related to Organisation - Departmentation and Decentralisation, Types of mechanistic and organic structures of organisation (Line organization, Line and staff organization, functional organization, Committee organization, matrix organization, Virtual Organisation, Cellular Organisation, team structure, boundaryless organization, inverted pyramid structure, lean and flat organization structure) and their merits, demerits and suitability.

Unit III: ***Operations Management*****:** Principles and Types of Plant Layout-Methods of production (Job, batch and Mass Production), Work Study -Basic procedure involved in Method Study and Work Measurement- Statistical Quality Control: $\bar{x}$ chart, R chart, *c* chart, *p* chart, (simple Problems), Acceptance Sampling, Deming's contribution to quality.

Unit IV: ***A) Materials Management*****:** Objectives, Need for Inventory control, EOQ, ABC Analysis, Purchase Procedure, Stores Management and Stores Records - Supply Chain Management

B) Marketing**:** Functions of Marketing, Marketing Mix, Marketing Strategies based on Product Life Cycle., Channels of distribution.

Unit V: ***Human Resources Management (HRM):*** Concepts of HRM, HRD and Personnel Management and Industrial Relations (PMIR), HRM vs. PMIR, Basic functions of HR Manager: Manpower planning, Recruitment, Selection, Training and Development, Placement, Wage and Salary Administration, Promotion, Transfer, Separation, Performance Appraisal, Grievance Handling and Welfare Administration, Job Evaluation and Merit Rating.

Unit VI: ***Project Management (PERT/CPM*****):** Network Analysis, Programme Evaluation and Review Technique (PERT), Critical Path Method (CPM), Identifying critical path, Probability of Completing the project within given time, Project Cost Analysis, Project Crashing. (simple problems)

Unit VII: ***Strategic Management*****:** Mission, Goals, Objectives, Policy, Strategy, Programmes, Elements of Corporate Planning Process, Environmental Scanning, SWOT Analysis, Steps in Strategy Formulation and Implementation, Generic Strategy alternatives.

Unit VIII: ***Contemporary Management Practices*****:** Basic concepts of Just-In-Time (JIT) System, Total Quality Management (TQM), Six sigma and Capability Maturity Model (CMM) Levels, Value Chain Analysis,Enterprise Resource Planning (ERP), Performance Management, Business Process outsourcing (BPO), Business Process Re-engineering and Bench Marking, Balanced Score Card.

Text Book:

1. Aryasri: *Management Science*, TMH, New Delhi.

Reference Books:

1. Kotler Philip & Keller Kevin Lane: Marketing Mangement 12/e, PHI, 2007
2. Koontz & Weihrich: *Essentials of Management*, 6/e, TMH, 2007
3. Thomas N.Duening & John M.Ivancevich *Management—Principles and Guidelines,* Biztantra,2007.
4. Kanishka Bedi, *Production and Operations Management*, Oxford University Press, 2007.
5. Memoria & S.V.Ganker, *Personnel Management*, Himalaya, 25/e, 2007
6. Schermerhorn: *Management*, Wiley, 2007.
7. Parnell: Strategic Management, Biztantra,20073.
8. L.S.Srinath: PERT/CPM,Affiliated East-West Press, 2007.

Pre-requisites: Managerial Economics

Objective**:** To familiarize with the process of management and to provide basic insights into select contemporary management practices.

Codes/Tables: Normal Distribution Function Table need to be permitted into the examination Hall.

Question Paper Pattern: 5 Questions to be answered out of 8 questions.
Each question should not have more than 3 bits.

Unit VIII will have only short questions, not essay questions.

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FLIGHT MECHANICS – I

UNIT-I
AERODYNAMIC CHARACTERISTICS
Airfoils, wings and bodies: geometry, nomenclature. Aerodynamic characteristics. Effect of geometry, Reynolds number, Mach no. Measures of aerodynamic performance. Performance augmentation methods.

UNIT –II
DRAG AND THRUST EVALUATIONS
Drag of aerospace vehicle components. Total drag estimation, Methods of drag reduction, Propellers, Performance analysis. Aerospace engines reciprocating, turbine and rockets. Design features. Performance characteristics.

UNIT –III
AIRCRAFT PERFORMANCE IN STEADY FLIGHT
Level flight, Stall, Cruise, Maximum speed, Ceiling, Cruise climb, Range and endurance. Climb performance, Performance optimization.

UNIT-IV
PERFORMANCE IN ACCELERATED FLIGHT
Take-off and landing. Level turns and maneuvers.
UNIT-V
PERFORMANCE OF ROCKETS AND MISSILES
Principal design features of rockets and missiles. Types, Applications, Staging, Launch and Climb. Performance in boost glide, boost sustain, long range cruise and long - range ballistic trajectories.

UNIT-VI
Introduction to Flight path and performance optimizations.

UNIT-VII
Introduction to Sonic boom and hazards of Transonic and Supersonic Flight. Flight path control based on Ground noise considerations.

UNIT-VIII
Rigid Body Mechanics relevant to Aircrafts, space crafts and Missiles.

TEXT BOOKS
1. Anderson, J .D., Aircraft Performance and Design, Mc Graw-Hill International Edition 1999
2. Clancy, L.J., Aerodynamics, Pitman, 1986

REFERENCES:
1. PerPerkins, C.D., and Hage, R.E., Airplane Performance and Stability and Control, Wiley Toppan, 1974
2. Milne Thomson, Theoretical Aerodynamics, Macmillan, 1985
3. Houghton, E.L., and Carruthers, N.B., Aerodynamics for Engineering Students, Edward Arnold Publishers Ltd., London, 1989
4. Chin SS, Missile Configuration Design, Mc Graw Hill, New York, 1961.

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AERODYNAMICS – II

Tables/Codes: Isentropic Expansion, Normal Shock, Oblique Shock.

UNIT-I

ONE DIMENSIONAL FLOWS

Isentropic process for closed system/flow processes. Velocity of sound. Mach number, flow regimes. Governing equations of inviscid compressible flow. Continuity, Momentum and Energy equations in Integral and Differential form. Stagnation conditions.

UNIT-II

FLOW THROUGH NOZZLES

Isentropic flow through Convergent – Divergent nozzles. Chocked flow conditions. Normal shock. Under and Over expansion conditions. Flow through diffusers – wave reflections from a free boundary. Description of supersonic wind tunnels and rocket engine.

UNIT-III

OBLIQUE SHOCKS AND EXPANSION WAVES

Oblique shock relations. Super sonic flow over a wedge .. , M relations strong and weak shock solutions / Shock polar. Regular reflection from a solid boundary. Intersections of shock wave. Expansion waves. Prandtl – Meyer Expansion.

UNIT-IV

SUBSONIC COMPRESSIBLE FLOW OVER AIRFOIL

Introduction - Velocity potential equation – Transonic small perturbation equation - Prandtl-Glauert compressibility corrections - Critical Mach number - Drag divergence Mach number - Area rule - Supercritical airfoil.

UNIT-V

SUPERSONIC FLOW

Linearized supersonic flow- Linearized supersonic flow over airfoil and wings. Shock Expansion theory. Detached shock. Axi-symmetrical flows-flow past slender bodies of revolution, conical flows-Numerical integration procedure.

UNIT-VI

HYPERSONIC FLOWS

Qualitative aspects of hypersonic flow. Newtonian theory. Flat plate at an angle of attack. Hypersonic shock wave relations. Lift and drag of wings at hypersonic speeds. Recent advances in hypersonic flows and testing techniques.

UNIT-VII

FLOW MEASUREMENTS AND MODEL TESTING

Non dimensional parameters andII numbers Similarity of flows. Model testing in wind tunnels. Pressure, Velocity measurements – Hotwire and Laser – Doppler anemometer, Turbulence measurements. Measurement errors. Test section speed, horizontal buoyancy, flow angularities.

UNIT-VIII

FORCE MEASUREMENTS WIND TUNNEL BALANCES

Force measurements – Wind tunnel balances. Scale effects and corrections, wall interferences, induced drag and other computations/corrections.

TEXTBOOKS

1. Anderson, J .D., Fundamental of Aerodynamics, Mc Graw-Hill International third edition Singapore-2001.
2. Radhakrishnan, E, E., Gas Dynamics, Prentice Hall of India, 1995

RFFERENCES

1. Anderson, J .D., Modern Compressible Fluid Flow, Mc Graw-Hill International Edition
2. Hodge B.K & Koenig K Compressible Fluid Dynamics with Computer Application, Prentice Hall, 1995
3. Clancy, L.J., Aerodynamics, Pitman, 1986, Macmillan, 1985

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III Year B. Tech. AE – I semester

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AEROSPACE VEHICLE STRUCTURES – I

UNIT I
REDUNDANT STRUCTURES
Indeterminate structures and order of redundancy. Introduction to redundant analysis. Statically determinate models. Use of free body diagrams to explain compatibility and redundant analysis principles. Matrix methods of redundant analysis utilizing (a) equilibrium equations / compatibility conditions and (b) Singularity method for uniform beams with various boundary and support conditions (props, hinges and fixities) subjected to distributed / discrete loads (including moments).

UNIT II
BEAMS WITH ELASTIC SUPPORTS AND INITIAL CURVATURE:
Direct solution of beams on elastic foundation Deflection of beams with discrete elastic supports using singularity methods and modeling concepts. Equation of equilibrium for curved beam stress and deflections of a typical curved beam (Bulk Head segments on fuselages).

UNIT III
STABILITY
Stability of Structural systems, Modes of instability of columns. Euler's formula for critical loads of column. Slenderness ratio, Effect of boundary conditions on mode shapes and critical loads. Column with initial curvature, effect of eccentricity. Long, medium and short column ranges. Rankine and Jhonson's formulae. Eigen values and Eigen modes. Effect of intermediate supports. Concept of beam column.

UNIT IV
INTRODUCTION TO THEORY OF ELASTICITY
Equilibrium and Compatibility conditions for elastic solids. 2D elasticity equations for plane stress, plane strain and generalized plane strain cases Airy's stress function. Simple problems in plane stress / plane strain using Cartesian and polar coordinates. Super position techniques. Examples include (a) panels subjected to a Generalized plane strain Biaxial loading (b) Uniform/Linearly varying edge loads on elastic half plane (c) Thick cylindrical shells.

UNIT V
Stresses and Strains on arbitrary planes and transformations. Concept of principal planes, stress and Strains. Construction of Mohr's circle. Failure mechanism and fracture modes.

UNIT - VI
ENERGY PRINCIPLES AND METHODS
Introduction to energy principles and methods. Principles of Virtual Displacement and Principle of Virtual Force Castigliano's theorems, Maxwell's reciprocal theorem and Unit load method. Direct application of energy principles to beams and trusses.

UNIT – VII
The displacement method (Rayleigh Ritz method). Admissible functions energy and work expressions for redundant analysis of 1-D structures (rods, shafts and beams). Various 1D Structures subjected to Complex loading. Stresses, of errors and convergence.

UNIT - VIII
SHEAR FLOW IN CLOSED SECTIONS
Bredt-Batho formula. Single and multi-cell closed box structures. Semi monocoque and moncoque structures. Approximate method for box beams. Shear flow in single and multicell monocoque and semi monocoque box beams subject to torsion.

TEXTBOOKS:

1. Timoshenko S. P. and J.N. Goodier, "Theory of Elasticity McGraw Hill Book Co.
2. Donaldson, B. K. Analysis of Aircraft Structues-An introduction "McGraw Hill.

REFRENCES

1. Shames I. H. and Dym C. L. Energy and finite element methods structural analysis McGraw Hill
2. Megson THG, "Aircraft Structures for Engineering students", Edward Arnold Publication.
3. B.C.Punmia, "Theory of Structures", Laxmi Publication.
4. S.Ramamrutham, R.Narayanan, "Theory of Structures" – Dhanpat Rai Publishing Co, 2003.
5. Argyris J. H. and Kelsey S. energy theorems and structural analysis, Butterworths Scientific Publications.1960

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AEROSPACE PROPULSION – I

UNIT -I
FUNDAMENTALS OF GAS TURBINE ENGINES
Illustration of working of gas turbine engine - The thrust equation - Factors affecting thrust – Effect of pressure, velocity and temperature changes of air entering compressors – Method of thrust augmentation – Characteristics of turboprop, turbojet – Performance characteristics.

UNIT - II
SUBSONIC INLETS
Internal flow and Stall in Subsonic inlets - Boundary layer separation – Major features of external flow near a subsonic inlet – Relation between minimum area ratio and eternal deceleration ratio - Diffuser performance .

UNIT - III
SUPERSONIC INLETS
Supersonic inlets - Starting problem in supersonic inlets - Shock swallowing by area variation- External deceleration – Modes of inlet operation.

UNIT - IV
COMBUSTION CHAMBERS AND PERFORMANCE
Classification of combustion chambers – Important factors affecting combustion chamber design – Combustion process – Combustion chamber performance.

UNIT - V
PERFORMANCE SENSITIVITY
Effect of operating variables on performance - Flame tube cooling - Flame stabilization – Use of flame holders – Numerical problems.

UNIT - VI
NOZZLES
Theory of flow in isentropic nozzles - Convergent nozzles and nozzle choking – Nozzle throat conditions – Nozzle efficiency – Losses in nozzles – Over-expanded and under-expanded nozzles - Ejector and variable area nozzles - Interaction of nozzle flow with adjacent surfaces – Thrust reversal .

UNIT - VII
CENTRIFUGAL COMPRESSORS
Principle of operation of centrifugal compressors - Work done and pressure rise -
Velocity diagrams - Diffuser vane design considerations – Concept of Prewhirl –
Rotating stall.

UNIT - VIII
AXIAL FLOW COMPRESSORS
Elementary theory of axial flow compressor – Velocity triangles – Degree of reaction - Three dimensional flow - Air angle distribution for free vortex and constant reaction designs - Compressor blade design - Centrifugal and Axial compressor performance characteristics.

TEXT BOOKS
1. Mathur M L & Sharma R P; Gas Turbines and Jet & Rocket Propulsion, Standard Publisher, Delhi, 2000.
2. Cohen, H. Rogers, G.F.C. and Saravanamuttoo, H.I.H. Gas Turbine Theory, Longman, ELBSEd, 1989.

REFERENCES
1. Oates G C, AeroThermodyanamics of Aircraft Engine Components, AIAA Edn. Services, NY, 1986.
2. Rolls- Royce, Jet Engine, 3rd edition, 1983.
3. Ganesan V, Gas Turbines, TMGH Pub Co & ed, Delhi, 1999.
4. Philipa Hill and Carl Peterson, Mechanics and Thermodynamics of Propulsion, Addison Wesley Longman Inc, 1999.

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	4+1*	**0**	**4**

CONTROL SYSTEMS

UNIT – I INTRODUCTION
Concepts of Control Systems- Open Loop and closed loop control systems and their differences- Different examples of control systems- Classification of control systems, Feed-Back Characteristics, Effects of feedback. Mathematical models – Differential equations, Impulse Response and transfer functions - Translational and Rotational mechanical systems

UNIT II TRANSFER FUNCTION REPRESENTATION
Transfer Function of DC Servo motor - AC Servo motor- Synchro transmitter and Receiver, Block diagram representation of systems considering electrical systems as examples -Block diagram algebra – Representation by Signal flow graph - Reduction using mason's gain formula.

UNIT-III TIME RESPONSE ANALYSIS
Standard test signals - Time response of first order systems – Characteristic Equation of Feedback control systems, Transient response of second order systems – Time domain specifications – Steady state response - Steady state errors and error constants – Effects of proportional derivative, proportional integral systems.

UNIT – IV STABILITY ANALYSIS IN S-DOMAIN
The concept of stability - Routh stability criterion – qualitative stability and conditional stability
Root Locus Technique:
The root locus concept - construction of root loci-effects of adding poles and zeros to G(s)H(s) on the root loci.

UNIT – V FREQUENCY RESPONSE ANALYSIS
Introduction, Frequency domain specifications-Bode diagrams-Determination of Frequency domain specifications and transfer function from the Bode Diagram-Phase margin and Gain margin-Stability Analysis from Bode Plots.

UNIT – VI STABILITY ANALYSIS IN FREQUENCY DOMAIN
Polar Plots, Nyquist Plots and applications of Nyquist criterion to find the stability – Effects of adding poles and zeros to G(s)H(s) on the shape of the Nyquist diagrams.

UNIT – VII CLASSICAL CONTROL DESIGN TECHNIQUES
Compensation techniques – Lag, Lead, Lead-Lag Controllers design in frequency
Domain, PID Controllers.
UNIT – VIII STATE SPACE ANALYSIS OF CONTINUOUS SYSTEMS
Concepts of state, state variables and state model, derivation of state models from block diagrams, Diagonalization- Solving the Time invariant state Equations- State Transition Matrix and it's Properties

TEXT BOOKS:
1. Control Systems Engineering – by I. J. Nagrath and M. Gopal, New Age International (P) Limited, Publishers, edition.
2. Modern Control Engineering – by Katsuhiko Ogata – Prentice Hall of India Pvt. Ltd., 3rd edition, 1998.

REFERENCES:
1. Control Systems by N.K.Sinha, New Age International (P) Limited Publishers, 3rd Edition, 1998.
2. Automatic Control Systems 8th edition– by B. C. Kuo 2003– John wiley and son's.
3. Control Systems Engg. by NISE 3rd Edition – John Wiley
4. " Modelling & Control Of Dynamic Systems" by Narciso F. Macia George J. Thaler, Thomson Publishers.

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ADVANCED ENGLISH COMMUNICATION SKILLS LAB

1. Introduction

The introduction of the English Language Lab is considered essential at 3rd year level. At this stage the students need to prepare themselves for their careers which may require them to listen to, read, speak and write in English both for their professional and interpersonal communication in the globalised context.

The proposed course should be an integrated theory and lab course to enable students to use 'good' English and perform the following:

- Gather ideas and information, to organise ideas relevantly and coherently.
- Engage in debates.
- Participate in group discussions.
- Face interviews.
- Write project/research reports/technical reports.
- Make oral presentations.
- Write formal letters.
- Transfer information from non-verbal to verbal texts and vice versa.
- To take part in social and professional communication.

2. Objectives:

This Lab focuses on using computer-aided multimedia instruction for language development to meet the following targets:

- To improve the students' fluency in English, through a well-developed vocabulary and enable them to listen to English spoken at normal conversational speed by educated English speakers and respond appropriately in different socio-cultural and professional contexts.
- Further, they would be required to communicate their ideas relevantly and coherently in writing.

3. Syllabus:

The following course content is prescribed for the Advanced Communication Skills Lab:

- Functional English - starting a conversation – responding appropriately and relevantly – using the right body language – role play in different situations.
- Vocabulary building – synonyms and antonyms, word roots, one-word substitutes, prefixes and suffixes, study of word origin, analogy, idioms and phrases.
- Group Discussion – dynamics of group discussion , intervention, summarizing, modulation of voice, body language, relevance, fluency and coherence.
- Interview Skills – concept and process, pre-interview planning, opening strategies, answering strategies, interview through tele and video-conferencing.
- Resume' writing – structure and presentation, planning, defining the career objective, projecting ones strengths and skill-sets, summary, formats and styles, letter-writing.
- Reading comprehension – reading for facts, guessing meanings from context, scanning, skimming, inferring meaning, critical reading.
- Technical Report writing – Types of formats and styles, subject matter – organization, clarity, coherence and style, planning, data-collection, tools, analysis.

4. Minimum Requirement:

The English Language Lab shall have two parts:

i) **The Computer aided Language Lab** for 60 students with 60 systems, one master console, LAN facility and English language software for self- study by learners.

ii) **The Communication Skills Lab** with movable chairs and audio-visual aids with a P.A System, a T. V., a digital stereo –audio & video system and camcorder etc.

System Requirement (Hardware component):

Computer network with Lan with minimum 60 multimedia systems with the following specifications:

iii) P – IV Processor

a) Speed – 2.8 GHZ
b) RAM – 512 MB Minimum

c) Hard Disk – 80 GB

iv) Headphones of High quality

5. Suggested Software:

The software consisting of the prescribed topics elaborated above should be procured and used.

Suggested Software:

- **Clarity Pronunciation Power** – part II
- **Oxford Advanced Learner's Compass**, 7th Edition
- **DELTA's key to the Next Generation TOEFL Test: Advanced Skill Practice.**
- **Lingua TOEFL CBT Insider**, by Dreamtech
- **TOEFL & GRE**(KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)
- **The following software from 'train2success.com'**
  - **Preparing for being Interviewed,**
  - **Positive Thinking,**
  - **Interviewing Skills,**
  - **Telephone Skills,**
  - **Time Management**
  - **Team Building,**
  - **Decision making**
- **English in Mind**, Herbert Puchta and Jeff Stranks with Meredith Levy, Cambridge

6. Books Recommended:

1. **Effective Technical Communication**, M. Ashraf Rizvi, Tata Mc. Graw-Hill Publishing Company Ltd.
2. **A Course in English communication** by Madhavi Apte, Prentice-Hall of India, 2007.
3. **Communication Skills** by Leena Sen, Prentice-Hall of India, 2005.
4. **Academic Writing- A Practical guide for students** by Stephen Bailey, Rontledge Falmer, London & New York, 2004.
5. **English Language Communication : A Reader cum Lab Manual** Dr A Ramakrishna Rao, Dr G Natanam & Prof SA Sankaranarayanan, Anuradha Publications, Chennai
6. **Body Language- Your Success Mantra** by Dr. Shalini Verma, S. Chand, 2006.
7. **DELTA's key to the Next Generation TOEFL Test: Advanced Skill Practice**, New Age International (P) Ltd., Publishers, New Delhi.
8. Books on **TOEFL/GRE/GMAT/CAT** by Barron's/cup
9. **IELTS series with CDs** by Cambridge University Press.
10. **Technical Report Writing Today** by Daniel G. Riordan & Steven E. Pauley, Biztantra Publishers, 2005.
11. **Basic Communication Skills for Technology** by Andra J. Rutherford, 2nd Edition, Pearson Education, 2007.
12. **Communication Skills for Engineers** by Sunita Mishra & C. Muralikrishna, Pearson Education, 2007.
13. **Objective English** by Edgar Thorpe & Showick Thorpe, 2nd edition, Pearson Education, 2007.
14. **Cambridge Preparation for the TOEFL** Test by Jolene Gear & Robert Gear, 4th Edition.
15. **Technical Communication** by Meenakshi Raman & Sangeeta Sharma, Oxford University Press.

DISTRIBUTION AND WEIGHTAGE OF MARKS:

Advanced Communication Skills Lab Practicals:

1. The practical examinations for the English Language Laboratory practice shall be conducted as per the University norms prescribed for the core engineering practical sessions.

2. For the English Language lab sessions, there shall be a continuous evaluation during the year for 25 sessional marks and 50 End Examination marks. Of the 25 marks, 15 marks shall be awarded for day-to-day work and 10 marks to be awarded by conducting Internal Lab Test(s). The End Examination shall be conducted by the teacher concerned with the help of another member of the staff of the same department of the same institution.

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AERODYNAMICS AND PROPULSION LAB

AERODYNAMICS LAB

1. Fluid flow studies using blower
2. Calibration of low speed wind tunnel
3. Drag of different bodies
4. Pressure distribution studies on two-dimensional models
5. Pressure distribution over an airfoil at different angles of attack
6. Aero dynamic Characterization on NACA - 0012 Air Foil
7. Axial Flow Compressor
8. Centrifugal Flow Compressor
9. Flow Visualization Techniques.

PROPULSION LAB

1. Study of piston engine (Valve Timing And Port Timing Diagram)
2. Stripping of a piston engine, visual inspection and reasoning for common troubles and trouble shooting
3. Performance of piston engine
4. Heat Balance Test on piston engine
5. Engine Balancing
6. Characterization of Aviation fuels

Equipment needed

1. Low Speed Wind-tunnel Test Rig with a test section of 1 meter X 1 meter with necessary accessories.
2. Test Rig for Axial flow Compressor
3. Test rig for centrifugal flow compressor.
4. Heat Engine Test Rig.
5. Balancing test Rig
6. Calorimeter apparatus
7. Piston Engine

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III Year B. Tech. AE – II semester	**T**	**P**	**C**
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FLIGHT MECHANICS - II

UNIT – I

Degree of freedom of a system - Static and dynamic stability - Need for stability in an airplanes - Purpose of controls - Inherently and marginally stable airplanes.

UNIT – II

EQUATIONS OF MOTION

Equations of motion of a rigid body. Inertial forces and moments. Equations of motion of flight vehicles. Aerodynamic forces and moments. Decoupling of longitudinal and lateral-directional equations. Linearization of equations.

UNIT - III

AERODYNAMIC STABILITY DERIVATIVES

Aerodynamic stability and control derivatives. Relation to geometry, flight configuration. Effects of power, compressibility and flexibility.

UNIT – IV

STATIC LONGITUDINAL STABILITY AND CONTROL – CONTROL FIXED

Stick Fixed: Basic equilibrium equation - Stability criterion – Contribution of wing and tail and elevator to pitching moments - Effect of fuselage and nacelles - Effects of center of gravity location - Power effects - Stabilizer setting and center of gravity location – Elevator power– Elevator to trim . Trim gradients. Control fixed static stability – Control fixed neutral point. Stability margins.

UNIT – V

STATIC LONGITUDINAL STABILITY – CONTROL FREE

Effects of releasing the elevator. Hinge moment coefficients – Control forces to trim. Control free neutral point – Trim tabs. Aerodynamic balancing of control surfaces. Means of augmentation of control.

UNIT – VI

MANEUVER STABILITY

Contribution of pitch damping to pitching moment of flight vehicle - Effect on trim and stability. Control deflections and control forces for trim in symmetric maneuvers and coordinated turns. Control deflection and force gradients. Control fixed and control free maneuver stability. Maneuver points. Maneuver margins.

UNIT – VII

STATIC LATERAL AND DIRECTIONAL STABILITY AND CONTROL

Dihedral effect - Coupling between rolling and yawing moment - Adverse yaw - Aileron power - Aileron reversal. Weather cocking effects – Rudder power. Lateral and directional stability- definition. Control surface deflections in steady sideslips, rolls and turns one engine inoperative conditions - Rudder lock.

UNIT – VIII

DYNAMIC STABILITY AND RESPONSE TO CONTROL.

Solutions to the stability quartic of the linearised equations of motion. The principal modes. Phugoid , Short Period Dutch Roll and Spiral modes - Further approximations. Restricted degrees of motion. Solutions. Response to controls. Auto rotation and spin.

TEXT BOOKS

1. Houghton, E.L., and Carruthers, N.B., Aerodynamics for Engineering Students, Edward Arnold Publishers Ltd., London, 1989
2. Mc.Cormic, B.W., Aerodynamics, Aeronautics & Flight Mechanics, John Wiley 1995

REFERENCES

1. Perkins C.D., & Hage, R.E., Airplane Performance, Stability and Control, Wiley Toppan 1974.
2. Nelson, R.C., Flight Stability and Automatic Control, McGraw Hill 1989

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AEROSPACE VEHICLE STRUCTURES – II

UNIT – I
LOAD DIFFISION IN STIFFNED PANELS
Wagner's theory of beams. Shear carrying capabilities of panels and introduction to Tension field webs. Semi tension and complete tension field beams. Monocoque and semi Monocoque structures.

UNIT – II
SHEET STRINGER COMBINATIONS
Axial Load flow diagrams for boom in stiffened panels. Simple illustrative examples of A/C sheet stringer elements through free body diagrams. Load diffusion in thin walled panels with oblique stiffeners.

UNIT – III
STABILITY OF PANELS
Stability of stiffened panels. Effective width concept. Simple estimations of load carrying capability of stressed skins of Aircraft wing shells.

UNIT – IV
SHEAR FLOW IN OPEN SECTIONS SUBJECTED TO PURE BENDINGS
Thin walled beams - Shear centre and Elastic axis Concept of shear flow beams with one axis of symmetry, Unsymmetrical box beam with effective and ineffective skins
.
UNIT - V
STRESS ANALYSIS OF WING AND FUSELAGE
Procedure - Shear and bending moment distribution for semi cantilever and other types of wings and fuselages - Thin webbed beam with parallel and non parallel flanges - Shear resistant web beams.

UNIT - VI
TORSION BENDING OF OPEND TUBES
Torsion bending phenomena. Torsion bending constant and specific torsion bending strength Simple derivation of torsion bending equation. The phenomena of warping. Stresses in cantilever, I-beam by solution of general differential equation for torsion beam.

UNIT – VII
INHIBITION OF AXIL CONSTRAINT STRESS
Torsion of thin walled beams with open sections effect of axial constraints. Primary and Secondary warping phenomena. Computation of torsion bending constant for open tubes with cross sections such as Channel, T and Angle.

UNIT – VIII
AIRCRAFT SKIN STIFFNERS
Methods of improving torsion bending strength by lipping, as an effective means of improving torsion bending constant. Computation of improvement of specific torsion bending strength in lipped Channel, T, I, L, sections over the unlipped counter parts

TEXT BOOKS
1. Megson, T.M.G., Aircraft Structures for Engineering Students, Edward Arnold, 1985.
2. J.T. Oden, "Mechanics of Elastic Structures", McGraw-Hill. 1967
3. Scheler.E.E and Dunn L.G, "Airplane Structural Analysis and Design", John Wiley & Sons.1963

REFERENCES
1. Peery, D.J, and Azar, J.J., Aircraft Structures, 2nd edition, Mc Graw-Hill, N.Y., 1993.
2. Rivello, R.M., Theory and Analysis of Flight Structures, McGraw Hill, 1993.
3. Bruhn. E.H, Analysis and Design of Flight Vehicles Structures, tri -state off set company, USA, 1965.
4. Kuhn.P, "Stresses in Aircraft and Shell Structure", McGraw-Hill.
5. William.D, "An Introduction to the Theory of Aircraft Structures", Edward Arnold.

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AEROSPACE PROPULSION – II

UNIT - I
GAS TURBINE THEORIES
Impulse and reaction blading of gas turbines - Velocity triangles and power output - Elementary theory - Vortex theory - Choice of blade profile, pitch and chord - Estimation of stage performance.

UNIT – II
DESIGN CONSILRETIONS
Limiting factors in gas turbine design - Overall turbine performance - Methods of blade cooling - Matching of turbine and compressor - Numerical problems.

UNIT – III
THRUST CONTROL
Thrust Augmentation through after burning, thrust vector control methods.

UNIT – IV
RAMJET PROPULSION
Operating principle- Subcritical, critical and supercritical operation - Combustion in ramjet engine - Ramjet performance - Sample ramjet design calculations – Introduction to SCRAMJET - Preliminary concepts in supersonic combustion - Integral ram - Rocket - Numerical problems.

UNIT - V
FUNDAMENTALS OF ROCKET PROPULSION
Operating principle - Specific impulse of a rocket - Internal ballistics - Rocket nozzle classifications - Rocket performance considerations - Numerical problems.

UNIT - VI
CHEMICAL ROCKETS
Solid propellant rockets - Selection criteria of solid propellants - Important hardware components of solid rockets – Propellant grain design considerations.

UNIT - VII
Liquid propellant rockets - Cooling in liquid rockets - Limitations of hybrid rockets - Relative advantages of liquid rockets over solid rockets.

UNIT - VIII
ADVANCED PROPULSION TECHNIQUES
Electric rocket propulsion - Ion propulsion techniques - Nuclear rocket - Types - Solar sail- Preliminary concepts in nozzle less propulsion.

TEXT BOOKS

1. Sutton, G.P., Rocket Propulsion Elements, John Wiley & Sons Inc., New York, 5th Ed., 1993.
2. Philipa Hill and Carl Peterson, Mechanics and Thermodynamics of Propulsion, Addison Wesley Longman Inc, 1999.

REFERENCES

1. Marcl Bacare et. al. Rocket Propulsion, Elsevier Pub Co, 1960.
2. Zucrow M J, Aircraft & Missile Propulsion, John Wiley & Sons, NY, 1964.
3. Gorden, C.V., Aerothermodynamics of gas turbine and Rocket Propulsion, AIAA Education Series, New York, 1986.
4. Oates G C, AeroThermodyanamics of Aircraft Engine Components, AIAA Edn. Services, NY, 1986.
5. Rolls- Royce, Jet Engine, 3rd edition, 1983.
6. Cohen. H., Rogers, G.F.C. and Saravanamuttoo, H.I.H., Gas turbine theory, Longman Co., ELBS Ed., 1989.
7. Ganesan V, Gas Turbines, TMGH Pub Co & ed, Delhi, 1999.
8. Mathur, M., and Sharma, R.P., Gas Turbines and Jet and Rocket Propulsion, Standard Publishers, New Delhi, 1988.
9. S M Yahya, Fundamentals of Compressible Flow with Aircraft and Rocket propulsion, New Age International Pub, Delhi, 2003.

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FLIGHT VEHICLE DESIGN

UNIT-I
OBJECTIVES REQUIREMENTS OF THE VEHICLE : Type, role, mission. Payload, performance and other requirements. Study of comparable aircraft - principal design and constructional and performance. Data collection and statistical analysis.

UNIT-II
CONCEPTUAL SKETCH AND FIRST ESTIMATE OF WEIGHT : Conceptual sketch of candidate design- alternative configurations. First estimate of take off weight.

UNIT-III
INITIAL SIZING : Airfoil and wing geometry selection. Estimate of thrust to weight ratio and wing loading.

UNIT-IV
FUSELAGE AND CONTROL SURFACES : Sizing of Fuselage and control surfaces.

UNIT-V
CONFIGURATION LAYOUT : Layout and drawing of the configuration. Weightbalance

UNIT-VI
PERFORMANCE AND STABILITY ESTIMATE : Performance and stability estimate.

UNIT-VII
LOAD ESTIMATES : Airload distribution on the wing. Preliminary structural Layout.

UNIT-VIII
REVIEW : Review and evaluation of the design.

TEXT BOOKS
1. Raymer, Daniel P. Aircraft Design: A Conceptual Approach (Third Edition) AIAA Educational Series. AIAA 1999

REFERENCE
1. Torenbeek E. Synthesis of Subsonic Airplane Design. Delft University Press 1986
2. Bruhn. E.H, Analysis and Design of Flight Vehicles Structures, tri -state off set company, USA, 1965
3. Scheler.E.E and Dunn L.G, “Airplane Structural Analysis and Design”, John Wiley & Sons.1963

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FINITE ELEMENT AND MODELLING METHODS

UNIT – I
MODELS
Macro and Micro mechanical models and 'Basis of The Finite Element-formulations for developing and specification structural models. Equilibrium and energy bases for designing such as stiffness, flexibility, Inertia, damping and stability characteristics. Degrees of freedom and their relevance's to approximate methods of analysis

UNIT – II
GENERELIZED COORDINATES
Introduction to generalized coordinates and their classification based frames of reference (local/global), nature and utility. Field specific nature of such coordinates in time & space for representing both continuua and discontinua. Non dimensional coordinates, Area and Volume coordinates, utility of generalized coordinates in respresenting continuum and discrete systems.

UNIT – III
DISCRETIZATION
Role of interpolation (Hermitian and Langragian) functions in discretization – concepts of nodes and elements in discretizing 1 – D and 2 – D Solid fluid continuua. Examples of discretization of heat conduction, shear, axial, Torsional and Bending deformations of constant and stepped – 1-D structures. Discretization of plane stress Plain strain and 3-D space frame problems

UNIT – IV
PROPERTIES AND DERIVATION
Derivation of element property matrices from first principles - energy basis for deriving stiffness, mass element properties – Assembly Technique - Concept of work done and derivation of kinematically consistent load vectors Direct deduction of matrix equation of equilibria using assembly technique for property derivation for 1-D structures and frames.

UNIT – V
APPROXIMATIONS AND ERROR CONTROL
Nodal parametric representation of discrete domains and fields. Isoparametric, Subparametric and Superparametric representation. Injection of singularity in field distortions and their utility in fracture mechanics.

UNIT – VI
MATHEMATICAL TOOLS AND FEM TOOLS
Importance of designing codes in discretizing. Illustration of 1-D and 2-D field problems. Basics of Numerical integration and Gauss quadrature. Techniques of data storage and solution of storage of large scale matrices. Concept of bandwidth and Front widths and their minimization. In core, and out of core solution of based on matrices. Frontal techniques.

UNIT – VII
CONCEPTS OF SYMMETRY
Symmetries in 1-D, 2-D Structures including Axisymmetry. Symmetry Operations and Symmetry boundary conditions for fractional models in Analysis

UNIT – VIII
MESH GENERATION TECHNIQUES,
Using Commercial software's such as ANSYS, NISA, NASTRAN, ASKA, CAEFEM etc.

TEXT BOOKS
1. Concepts and Application of FEA, R.D.Cook, David S. MALKUS, Micheal E_PLESHA, Robert J. Witt Wiley Student Edition, India, 2002.
2. S S. Rao, "The Finite Element Methods in Engineering", Pergamon.2004

REFERENCES
1. Segarlind, L.J., Applied Finite Element Analysis, John Wiley and Sons, Inc., New York, 1991.
2. Desai, C.S and Abel, J.F., An introduction to the Finite Element Method, Affiliated East-West Press Pvt., Ltd., New Delhi, 1987.
3. Bathe, K.J. And Wilson, E.L., Numerical Methods in Finite Element Analysis, Prentice Hall of India, 1985.
4. Tirupathi R.Chandrupatla and Ashok D Belagundu, "Introduction to Finite Elements in Engineering", PHI 2006
5. "Finite Element and Modelling Methods", KSRK Prasad.

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III Year B. Tech. AE – II semester	**T**	**P**	**C**
	4+1*	**0**	**4**

INTRODUCTION TO SPACE TECHNOLOGY

UNIT-I
INTRODUCTION
Space Mission-Types-Space Environment-Launch Vehicle Selection

UNIT II
FUNDAMENTALS OF ROCKET PROPULSION
Introduction to rocket propulsion-fundamentals of solid propellant rockets- Fundamentals of liquid propellant rockets-Rocket equation

UNIT-III
ASCENT FLIGHT MECHANICS OF ROCKETS AND MISSILES
Two-dimensional trajectories of rockets and missiles-Multi-stage rockets-Vehicle sizing-Two stage Multi-stage Rockets-Trade-off Ratios-Single Stage to Orbit- Sounding Rocket-Aerospace Plane-Gravity Turn Trajectories-Impact point calculation-Injection conditions-Flight dispersions

UNIT-IV
ATMOSPHERIC REENTRY
Introduction-Steep Ballistic Reentry-Ballistic Orbital Reentry-Skip Reentry-"Double-Dip" Reentry - Aero-braking - Lifting Body Reentry
UNIT-V
FUNDAMENTALS OF ORBITAL MECHANICS
Two-body motion-Circular, elliptic, hyperbolic, and parabolic orbits-Basic Orbital Elements-Ground Trace
UNIT-VI
ORBITAL MANEUVERS
In-Plane Orbit changes-Hohmann Transfer-Bielliptical Transfer-Plane Changes- Combined Maneuvers-Propulsion for Maneuvers

UNIT -VII
SATELLITE ATTITUDE DYNAMICS
Torque free Axi-symmetric rigid body-Attitude Control for Spinning Spacecraft - Attitude Control for Non-spinning Spacecraft - The Yo-Yo Mechanism – Gravity – Gradient Satellite-Dual Spin Spacecraft-Attitude Determination

UNIT-VIII
SPACECRAFT POWER AND COMMUNICATION SYSTEMS
Spacecraft Power-Telecommunications

TEXT BOOKS
1. "Spaceflight Dynamics", W.E. Wiesel, McGraw-Hill, 1997
2. "Rocket Propulsion and Space flight dynamics", Cornelisse, Schoyer HFR, and Wakker KF, Pitman, 1984

REFERENCES
1. "Understanding Space: An Introduction to Astronautics", J.Sellers, McGraw- Hill, 2000
2. "Introduction to Space Flight", Francis J Hale, Prentice-Hall, 1994
3. "Spacecraft Mission Design", Charles D.Brown, AIAA Education Series, 1998
4. "Spacecraft Mission Design", Charles D.Brown, AIAA Education Series, 1998
5. "Elements of Space Technology for Aerospace Engineers", Meyer Rudolph X, Academic Press, 1999

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AEROSPACE STRUCTURES LAB

1. Tensile testing using universal Testing Machine - Mechanical and optical Extensometers - Stress - strain curves and strength tests for various engineering materials.
2. Bending tests - Stress and deflection of beams for various end conditions - Verification of Maxwell's and Castiglianos theorems - Influence coefficients.
3. Compression tests on long and short columns - Critical buckling loads – South well plot.
4. Test on riveted and bolted joints.
5. Test using NDT inspection method.
6. Strain gauge techniques - Measurement of strain in beams, thin and thick walled cylinders subjected to internal pressure - Shaft subjected to combined loading.
7. Shear centre in open and closed sections beams - Test on semi-tension field beams.
8. Elastic constants for composite materials - Flexural test on composites.
9. Study and calibration of photo and magnetic speed pickups for the measurement of speed.
10. Study and use of a Seismic pickup for the measurement of vibration amplitude.
11. Critical Fracture toughness of Aerospace material

Reference Books

1. Megson, T.M.G., Aircraft Structures for Engineering Students, Edward Arnold, 1985.
2. Bruhn. E.H, Analysis and Design of Flight Vehicles Structures, tri -state off set company, USA, 1965

Equipment needed

1. UTM – 20 / 40 Tons with. Jigs and Fixtures and precision Extensometers
2. Deflection test rig (Fabricated hardware + precession dial gauge)
3. Shear center Test rig
4. NDT Equipment. a) Ultrasonic apparatus, b) Magnetic Particle test rig ,c) Dye penetration test.
5. Strain Measuring equipment a) wheat stone Bridge b) Multi channel strain measuring equipment
   c) Various gauges / rosettes
6. Various Hardware rigs desired in the lab for specific test.

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FLIGHT VEHICLE DESIGN LAB

1. Objectives Requirements of the vehicle
2. Conceptual Sketch and first estimate of weight
3. Initial Sizing
4. Fuselage and control surfaces
5. Configuration layout.
6. Performance and stability Estimate
7. Load estimates

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VIBRATIONS AND STRUCTURAL DYNAMICS

UNIT I
INTRODUCTION
Simple harmonic motion, terminology, Newton's Law, D'Alembert's Prinicple, Resonance, Introduction to mechanism of damping. Damped and Undamped oscillations. Degrees of freedom. Various mechanisms of damping. Equivalent viscous damping.

UNIT II
SINGLE DEGREE OF FREEDOM SYSTEMS
Free vibrations, free damped vibrations, forced vibrations with and without damping. Support excitation and vibration measuring instruments. Amplitude and Phase response diagrams. Generalized single degree of freedom systems for continuous structures and computation of K, M and C.

UNIT III
MULTI DEGREE OF FREEDOM SYSTEMS
Two / Three degree of freedom systems, static and dynamic coupling, vibration absorbers, Principal coordinates, Principal modes, Othogonality conditions Hamilton's Principle, Lagrange's equation and application. Longintudinal vibration, lateral vibration, torsional vibration of shafts, dynamical equations of equilibria of elastic bodies, natural frequencies and modeshapes determination.

UNIT IV
Methods determining natural frequencies and mode shape. Natural Vibrations of solid continua. Determination of Eigen Values and Eigen modes.

UNIT V
Natural frequency of rotating shafts Whirling of shafts. Dynamic balancing of rotating shafts. Dynamic dampers.

UNIT VI
Introduction to approximate methods for frequency analysis Rayleigh Ritz method for vibration analysis. Diagonalization of stiffness, mass and damping matrices using orthogonality conditions.

UNIT VII
Matrices for dynamic analysis. Kinematically consistent Load systems and determination of [K], [M], [C] and [L] matrices. Normalization and formulation of modal equations.

UNIT VIII
Steady state response, using fourier analysis for decomposing complex periodie load functions, of modal equations using S-plane representation. Transient response analysis of modal equations using Duhamel's integrals.

TEXT BOOKS:

1. R.W. Clough and Penzien, "Dynamics of Structures". McGraw Hill 2nd Edition 1993
2. Mechanical Vibrations by Singiresure.S.Rao, Pearson Education LPE-2004.
3. Rao, J.S and Gupta .K., Theory and practice of Mechanical vibrations, Wiley Eastern Ltd., New Delhi, 2002.

REFERENCES:

1. Fug, Y.C., An Introduction to Theory of Aeroelasticity, John Wiley & Sons, NewYork, 1984
2. Timoshenko, S., Vibration Problems in Engineering, John Wiley and Sons, New York, 1987.
3. Shock and Vibrations by Harris & Creed Mc-Graw Hill book company, third edition.
4. Mechanical Vibrations by V.P.Singh, Dhanapati Rai and Co. 2003 edition.
5. Mechanical Vibrations by S.Grahamkelly- TMH 2004 edition.
6. Mechanical Vibrations G.K.Groover, Nemchand and Brothers 2001 edition.
7. Vibrations and waves CBS Publishers and Distributors MIT series 1987.
8. Scanlon, R.H., & Rosenbaum, R., "Introduction to the Study of Aircraft Vibration & Flutter." John Wiley and Sons, New York, 1982

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COMPUTATIONAL AERODYNAMICS

UNIT-I - BASICS
Introduction to computational fluid dynamics – Research tool – Design Tool, Finite control volume, infinitesimal fluid element, substantial derivatives, divergence of Velocity.

UNIT-II - GOVERNING EQUATIONS OF FLUID DYNAMICS
The continuity equation, the momentum equation, the energy equation, physical boundary conditions.

UNIT-III - SHOCK FITTING AND SHOCK CAPTURING
Form of Governing equation suited for CFD - Conservation form - shock fitting and shock capturing.

UNIT-IV - IMPACT OF PARTIAL DIFFERENTIAL EQAUTIONS ON CFD
Introduction, Classification of Quasi-Linear Partial differential equation, The Eigen value method, General behavior of different classes of Partial differential equation – elliptic, parabolic and hyperbolic.

UNIT-V - DISCRETIZATION
Introduction, Finite differences, difference equations, Explicit and implicit approaches, Errors and an analysis of stability.

UNIT-VI - TRANSFORMATIONS
Introduction, transformation of the governing partial differential equations, Matrices and the Jacobian of transformation

UNIT-VII - GRID GENERATIONS – I
Grid Generation techniques, Elliptic Grid Generator – Simply connected domain –
doubly connected domain.

UNIT-VIII - GRID GENERATIONS – II
Coordinate system control – Grid Point clustering, Introduction to Hyperbolic Grid Generation techniques and parabolic grid generator.

TEXT BOOKS
1. Hoffmann, K.A: Computational Fluid Dynamics for Engineers, Engineering Education System, Austin, Tex., 1989
2. Kreyszig,E., Advanced Engineering Mathematics, Wiley, New York

REFERENCES
1. John .D. Anderson " Computational Fluid Dynamics", McGraw Hill
2. Anderson, Dale A., John C. Tanhill and Richard H. Pletcher, "Computational Fluid Mechanics and Heat Transfer", McGraw Hill, New York 1984, Volumes I & II
3. Introduction to Computational Fluid Dynamics, Chow CY, John Wiley, 1979

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STRUCTURAL ANALYSIS AND DETAILED DESIGN

UNIT I

Design Philosophy of aircraft systems

- Principles of design
- Configuration design
- Arriving design specification for detailed design

UNIT II

DESIGN METHODOLOGIES

Emphasis on design procedures for the design of wings, fuselage, landing gear, pressure vessels including manevouring loads.

UNIT III

ENGINEERING DESIGN

Design of Aircraft parts and landing gears using engineering design methods/codes and standards to arrive at design for detailed analysis.

UNIT IV

FUSELAGE DESIGN

Loads, effective cross-section, bending strength shearflow analysis. Ultimate strength of stiffend Cylindrical Shells.

UNIT V

MODELLING AND SIMULATION OF WING SURFACES

Estimation of wing loading, wing idelization, mesh generation, element formulation, consistent load vectors, solutions and stress distribution.

UNIT VI

ANALYSIS OF LANDING GEAR

Evaluation of reaction loads on the members of the landing gear and analysis of lauding gear system, oleo strut, torque links.

UNIT VII

RELIABILITY BASED DESIGN

Reliability concepts, bath tub curve, design improvements for reliability.

UNIT VIII

FAILURE THEORIES

Maximum stress theory, Voin Mices theory, Minimum strain energy theory as applicable to aerospace structure and criteria for selection

TEXT BOOKS

1. Peery, D.J, and Azar, J.J., Aircraft Structures, 2nd edition, Mc Graw-Hill, N.Y., 1993.
2. Rivello, R.M., Theory and Analysis of Flight Structures, McGraw Hill, 1993.
3 J.T. Oden, “Mechanics of Elastic Structures”, McGraw-Hill. 1967
4. Scheler.E.E and Dunn L.G, “Airplane Structural Analysis and Design”, John Wiley & Sons.

REFERENCES

1. Megson, T.M.G., Aircraft Structures for Engineering Students, Edward Arnold, 1985.
2. Bruhn. E.H, Analysis and Design of Flight Vehicles Structures, tri -state off set company, USA, 1965. J.T. Oden, “Mechanics of Elastic Structures”, McGrawHill.
3. Kuhn.P, “Stressess in Aircraft and Shell Structure”, McGrawHill.
4. William.D, “An Introduction to the Theory of Aircraft Structures”, Edward Arnold.
5. Kermode.A.C, “The Airplane Structure”, Sir Issacc Pitman Publication.
6. Dowty G.H, “Structural Principles and Data”, The new ERA Publishing Cp, 1980.
7. Shigley JE, “Mechanical Engineering Design”.
8. Pandya & Shah, “Machine Design”

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AVIONICS

UNIT –I
BASICS
Basic principles of Avionics – Typical avionics sub system in civil/ military aircraft and space vehicles.

UNIT –II
FLIGHT DECK AND DISPLAY SYSTEMS
Flight deck display technologies – CRT, LED, LCD, Touch screen – Head up display – Electronic instrumentation systems.

UNIT-III
AUDIO AND COMMUNICATION SYSTEMS
Aircraft audio systems basic – audio transmitter and receiver principles – VHF communication system – UHF communication systems.

UNIT-IV
RANGING AND LANDING SYSTEMS
VHF Omnirange – VOR receiver principles – distance maturity equipment – principles of operation – Instrument landing system – localizer and glideslope.

UNIT-V
POSITIONG SYSTEM
Global positioning system principles – triangulation – position accuracy – applications in aviation.

UNIT-VI
INERTIAL NAVIGATION SYSTEM
Principle of Operation of INS – navigation over earth – components of inertial Navigation systems – accelerometers – gyros and stabilized platform.

UNIT-VII
SURVELLIENCE SYSTEM
ATC surveillance systems principles and operation interrogation and replay standards – Collision avoidance system – ground proximity warning system.

UNIT-VIII
AUTO FLIGHT SYSTEM
Automatic flight control systems – fly by wire and fly by light technologies – flight director systems – flight management systems. Integrated DATATRANSFER methodology by use of MILS – STD – 1553/ ARINC – 429.

TEXT BOOKS

1. Elements of electronic navigation, N.S.Nagaraja, Tata Mc Graw Hill, 1995.
2. Avionic systems Operation and maintenance, Janes W.Wasson, Jeppesen Sandersen Training products (Sterling Book House, Mumbai),1994.

REFERENCES

1. Principle of Avionics, Albert Hel frick, Avionics Communications Inc., 2000.
2. Aircraft Instrumentation and Integrated systems EHJ Pallet, Longan Scientific Technical (Sterling Book House, Mumbai) 1996.
3. Aircraft Radio Systems, J.Powell, Pitman publishers, 1998.

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EXPERIMENTAL STRESS ANALYSIS
(ELECTIVE – I)

UNIT – I
MEASUREMENTS
Basic principles, Accuracy, Sensitivity, Range Measurements, Errors.

UNIT – II
EXTENSOMETERS
Mechanical, Optical, Acoustical and Electrical extensometers and their use – Advantage and disadvantage.

UNIT – III
STRAIN GAUGE - PRINCIPLES
Principles and operation of electrical strain gauge- Requirement - Type and their uses, Material for strain gauge, Calibration, Cross sensitivity, Rosette Analysis.

UNIT - IV
STRAIN GAUGE – STRAIN MEASUREMENT
Wheatstone bridge and potentiometer circuits for static and dynamic strain measurements, Strain indicator.

UNIT – V
PHOTOELASTICITY
Two dimensional Photoelasticity, Concept of Light – Photo–elastic effects, Stress and optic law.

UNIT – VI
FRINGE INTERPOLATION TECHNIQUS
Interpretation of fringe pattern, Compensation and separation techniques, Photoelastic material.

UNIT – VII
NON-DESTRUCTIVE TESTING – I
Fundamentals of Non Destructive Testing, Radiography, Ultrasonic Inspection,Ultrasonic C-Scan, Magnetic particles Inspection, Fluorescent penetrant technique, Eddy current testing, Acoustic Emission Technique.

UNIT – VIII
NON-DESTRUCTIVE TESTING – II
Fundamentals of brittle coating methods, Intoduction to Moiré Techniques, Holography, Thermography.

TEXT BOOKS
1. Daily, J.W., and Riley, W.F., Experimental Stress Analysis, McGraw Hill Inc., New York 1978
2. Mechanical Measurement / Beckwith, Maragoni and Lienhard / Addision – Wesley

REFERENCES
1. Hetyenyi, M., Hand Book of Experimental Stress Analysis, John Wiley and Sons INC., New York, 1972
2. Srinath, L.S., Raghava, M.R., Lingaiah, K., Gargesha, G. Pant B., and Ramachandra, K., Experimental Stress Analysis, Tata McGraw Hill, New Delhi, 1984.
3. Pollock A.A., Acoustic Emission in Acoustics and Vibration Progress, Stephens R.W.B., Chapman and Hall, 1983.
4. Manufacturing Engineering Technology, Kalpakajam / Addision Wesley.

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IV Year B. Tech. AE – I semester	**T**	**P**	**C**
	4+1*	**0**	**4**

ANALYSIS OF COMPOSITE STRUCTURES
(ELECTIVE – I)

Coursse Objective:
This course mainly deals with imparting knowledge in the analysis of Multi-layered composite laminated plates using Micromechanics properties of composites materials, derivation of mechanical properties of laminates, generalized Hooke's Law & Stresses in Classical and laminated plates with symmetric, anti-symmetric and un-symmetric layered composites

UNIT-I
Introduction to laminated composite plates, Mechanical Properties of constituent materials such as Matrix and Filaments of different types.

UNIT-II
Netting analysis of composite materials, determination of properties of lamintes with fibers and matrices.

UNIT-III
Stress-Strain relations of Isotropic, Othotropic and Anisotropic materials, transformation of material properties for arbitrary orientation of fibres.

UNIT-IV
Methods of Analysis: Mechanics of materials approach to determine Young's modulus, Shear Modulus and Poisson's ratio, brief mention of elasticity approach and Macro mechanics of laminates

UNIT-V
Anisotropic elasticity, stress –strain relations in material coordinates - Transformation of geometric axes, strength concepts, Biaxial strength theories, Maximum stress and Maximum strain.

UNIT-VI
Analysis of laminated plates: Classical plate theory, Classical lamination theory – Special cases of single layer, symmetric, anti-symmetric & unsymmetric composites with cross ply, angle ply lay up. Deflection analysis of laminated plates. Analysis laminated beam and plates.

UNIT-VII
Shear deformation theories for composite laminated beams, plates.

UNIT-VIII
Buckling analysis of laminated composite plates with different orientation of fibres. Tsai-wu criteria and Tsai – Hill Criteria.

TEXT BOOKS/REFERENCES:

1. "Analysis and performance of fibre composites ", Agarwal B. D., Broutman. L. J., John Wiley and sons – New york, 1980.
2. Hand Book on "Advanced Plastics and fibre glass " , Lubin. G, Von. Nostrand, Reinhold Co. New york, 1989.
3. "Advanced Composite Materials" Lalith Gupta, Himalayan book, New Delhi, 1998.
4. " Mechanics of Composite Materials" Jones R.M. McGrawHill Kogakusha, ltd. Tokyo.

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AIRPORT MANAGEMENT
(Elective-1)

UNIT-I
AIRPORTS AND AIRPORT SYSTEMS
Introduction-Airport Management on an international level- Rules that govern airport management-Airport ownership and organization-Airport organization chart-Airport manager and public relations

UNIT-II
THE AIRFIELD
Components of an airport-The airfield-Navigation aids(NAVAIDS)located on airfields-Air traffic Control and surveillance facilities located on the airfield-Weather reporting facilities located on airfields-security infrastructure on airfields

UNIT-III
AIRSPACE AND AIR TRAFFIC CONTROL
Air traffic control management and operating infrastructure-Basics of air traffic control-Current and future enhancements to air traffic control

UNIT-IV
AIRPORT TERMINALS AND GROUND ACCESS
Historical development of airport terminals-Components of airport terminal-Airport ground access

UNIT-V
AIRPORT OPERATIONS MANAGEMENT
Pavement management-Aircraft rescue and fire fighting(ARFF)=Snow and ice control-Safety inspection programs-Bird and wildlife hazard management

UNIT-VI
AIRPORT SECURITY
Transportation Security Administration-Security at commercial service airports-Security at general aviation airports

UNIT-VII
AIRPORT FINANCIAL MANAGEMENT
Airport financial accounting-Revenue strategies at commercial airports-Pricing of airport facilities and services-Variation in the sources of operating revenues-Rise in airport financial burdens-Airport funding-Airport financing-Private investment-Sale of the airport

UNIT-VIII
AIRPORT CAPACITY AND DELAY
Defining capacity-Factors affecting capacity and delay-estimating capacity-Simulation Models-Defining delay-Estimating delay-Analytical estimates of delay: queuing diagram-Approaches to reducing delay-administrative and demand management

TEXT BOOK

Alexander T. Wells and Seth B. Young, “Airport Planning and Management”, (Fifth Edition), McGraw-Hill,2004

REFERENCES

1. Norman Ashford and H. P. Martin Stanton, “Airport Operations”, Mc-Graw-Hill, 1999

2. Anne Graham, “Managing Airports: An International Perspective”, Butterworth-Heinemann, 2003

3. Rigas Doganis, “The Airport Business”, Routledge, 1992

4.Richard D Neufville, “Airport Systems: Planning, Design and Management”, McGraw-Hill, 2002

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	4+1*	**0**	**4**

ENGINEERING OPTIMIZATION
(Elective-I)

UNIT-I
INTRODUCTION TO OPTIMIZATION
Statement of an Optimization Problem-Classification of Optimization Problems-Local and Global Optima

UNIT-II
CLASSICAL OPTIMIZATION TECHNIQUES
Single Variable Optimization-Multivariable Optimization with Equality Constraints- Direct Substitution-Method of Constrained Variation- Method of Lagrange Multipliers

UNIT-III
LINEAR PROGRAMMING
Applications of Linear Programming-Standard form of a Linear Programming Problem-Solution by graphical method-Simplex Method; Two phase and Big M methods-Revised simplex method- Duality in Linear Programming

UNIT-IV
TRANSPORTATION AND ASSIGNMENT PROBLEMS
Transportation Problem- North west corner method-Vogel's approximation method- MOD method-Assignment problems

UNIT-V
NON-LINEAR PROGRAMMING-UNCONSTRAINED OPTIMIZATION TECHNIQUES
Classification of Unconstrained Minimization-Powell's M-Steepest Dscent Method- Conjugate Gradient Method-Marquardt Method,Davidon-Fletcher-Powell Method, Broyden-Fletcher-Goldfarb-Shanno Method

UNIT-VI
NON-LINEAR PROGRAMMING -CONSTRAINED OPTIMIZATION TECHNIQUES
Characteristics of a Constrained Problem-Rosen's Gradient Projection Method- Penalty Function Method

UNIT-VII
INTEGER PROGRAMMING
Graphical Representation-Cutting Plane Method-Branch and Bound Method

UNIT-VIII
DYNAMIC PROGRAMMING
Multi-stage decision process-Computational Procedures in dynamic programming

TEXT BOOKS
1. "Engineering Optimization: Theory and Practice", S.S.Rao, New Age International(P) Ltd.
2. "Optimization for Engineering Dsign:Algorithms and Examples", K.Deb, Prentice-Hall, New Delhi,1995.

REFERENCES
1. **"**Introduction to Optimum design", J.S.Arora, McGraw Hill
2. "Numerical Optimization Techniques for Engineering Design", Vanderplatts, G.N., McGraw Hill

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	4+1*	**0**	**4**

INDUSTRIAL AERODYNAMICS
(ELECTIVE – I)

UNIT-I - ATMOSPHERE
Types of winds, Causes of variation of wind, Effect of terrain on gradient height.

UNIT-II - ATMOSPHERIC BOUNDARY LAYER
Pressure and velocity distribution over the rising car, Wind tunnel model for atmospheric boundary layer, variation of drag force for various positions of the rising car.

UNIT –III - WIND ENERGY COLLECTORS-I
Horizontal axis and vertical axis machines, Power coefficient, Betz coefficient by momentum theory.

UNIT –IV - WIND ENERGY COLLECTORS-II
Working principles of horizontal and vertical axis machines, Design of axial machines.

UNIT –V - VEHICLE AERODYNAMICS
Power requirements and drag coefficients of automobiles, Effects of cut back angle, Aerodynamics of trains and hovercraft.

UNIT –VI - BUILDING AERODYNAMICS
Pressure distribution on low-rise buildings, Wind forces on buildings, Environmental winds in city blocks, Special problems of tall buildings, Building codes, Building ventilation and architectural aerodynamics, Interference effect of Building.

UNIT –VII - FLOW INDUCED VIBRATIONS
Effects of Reynolds number on wake formation of bluff shapes, Vortex induced vibrations, Galloping and stall flutter.

UNIT-VIII - DESIGN OF CHIMNEY
Height of chimney for various gas effluents, Effective height of chimney, flume rise, Different types of flume rise for various climatic conditions.

TEXT BOOKS
1. Blevins, R.D., Flow Induced Vibrations, Van Nostard, 1990.
2. Calvert, N.G., Wind Power Principles, Charles Griffin & Co., London, 1979.

REFERENCES
1. Scorer, R.S., Environmental Aerodynamics, Ellis Harwood Ltd, England, 1978
2. Sovran, M., Aerodynamics Drag Mechanisms of Bluff Bodies and Road Vehicles, Plenum Press, N.Y., 1978.
3. Sachs. P., Wind Forces in Engineering, Pergamon Press, 1988.

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AIRLINE MANAGEMENT
(ELECTIVE – II)

UNIT-I
AIRLINE INDUSTRY
Structure of Airline Industry (Domestic & International)-Growth and Regulation-Deregulation-Major and National Carriers-Regional Carriers-Economic characteristics of the Airlines

UNIT-II
AIRLINE MANAGEMENT AND ORGANIZATION
Levels of Management-Decision Making-Functions of Management-Staff Departments-Line Departments

UNIT-III
INTRODUCTION TO AIRLINE PLANNING
Airline Planning Process-Airline Terminology and Measures: airline demand, airline supply, average load factor, unit revenue, Airline Planning Decisions: Fleet Planning, Route Evaluation, Schedule Development, Pricing, Revenue Management

UNIT-IV
FLEET PLANNING AND ROUTE EVALUATION
Factors in Fleet Planning-Hub-and-Spoke System-Technical Aspects-Fleet Rationalization-Fleet Commonality-Long Range Aircraft-Noise Restrictions-Factors in Design and Development-Fleet Planning Process; Route Evaluation in Hub Networks-Route profitability estimation issues-Demand Driven Dispatch

UNIT-V
AIRLINE SCHEDULING
The Mission of Scheduling-Equipment Maintenance-Flight Operations and Crew Scheduling—Ground Operations and Facility Limitations-Schedule Planning and Coordination-Equipment Assignment and Types of Schedules-Hub-and-Spoke Scheduling-Data Limitations in Airline Scheduling

UNIT-VI
AIRLINE PRICING, DEMAND AND OUTPUT
Airline pricing and demand-Determinants of demand-changes in demand-Elasticity of demand-determinants of elasticity; Types of passenger fares-Pricing process-Airline costs-Pricing and output determination

UNIT-VII
AIR CARGO
Introduction-Market for Airfreight-Types of Airfreight rates: General Commodity rates, Specific commodity rates, Exception rates, joint rates, Priority reserves air freight, speed package service, container rates-Specific Air freight services: assembly service, distribution service, pickup and delivery service-Factors affecting air freight rates:costs of service, volume of traffic, directionality, characteristics of traffic, value of service, competition

UNIT-VIII
REVENUE MANAGEMENT
Revenue Management Objectives-Airline revenue maximization-Differential Pricing –Yield Management-Revenue Management Techniques-Flight Overbooking-Flight Leg Revenue Management-Origin-Destination Control

TEXT BOOKS

1. Alexander T.Wells and John G.Wensveen,”Air Transportation:A Management Perspective”, (Fifth Edition),Brooks Cole,2003

REFERENCES

1. Charles Banfe, “Airline Management”, Prentice-Hall, 1991,
2. Rigas Doganis, “The Airline business”, Routledge, 2005
3. John .Wensveen, “Wheels Up:Airlines Business Plan Development”, Brooks Cole,2003
4. Stephen Holloway, “Straight and Level:Practical Airline Economics”,Ashgate Publishing, 2003
5. Stephen Shaw, “Airline Marketing and Management”, Ashgate Publishing, 2004
6. William O’ Connor, “An Introduction to Airline Economics” , (Sixth Edition), Praeger Publishers,2000
7. Peter P Belobaba,”Airline Management”, MIT Open Courseware Lecture Notes, 2006
8. Massoud Bazargan, “Airline Operations and Scheduling”, Ashgate Publishing, 2004

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IV Year B. Tech. AE – I Semester	**T**	**P**	**C**
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CAD/CAM
(ELECTIVE – II)

UNIT – I
Computers in Industrial Manufacturing, Product cycle, CAD / CAM Hardware, Basic structure, CPU, Memory types, input devices, display devices, hard copy devices, storage devices.

UNIT – II
Computer Graphics : Raster scan graphics coordinate system, database structure for graphics modeling, transformation of geometry, 3D transformations, mathematics of projections, clipping, hidden surface removal.

UNIT – III
Geometric modeling : Requirements, geometric models, geometric construction models, curve representation methods, surface representation methods, modeling facilities desired.

UNIT – IV
Drafting and Modeling systems : Basic geometric commands, layers, display control commands, editing, dimensioning, solid modeling, constraint based modeling.

UNIT – V
Numerical control : NC, NC modes, NC elements, NC machine tools, structure of CNC machine tools, features of Machining center, turning center, CNC Part Programming : fundamentals, manual part programming methods, Computer Aided Part Programming.

UNIT – VI
Group Tech : Part family, coding and classification, production flow analysis, advantages and limitations, Computer Aided Processes Planning, Retrieval type and Generative type.

UNIT – VII
Material requirement planning, manufacturing resources planning, DNC, AGV, ASRS, Flexible manufacturing systems – FMS equipment, system layouts, FMS control.

UNIT – VIII
CIM : Integration, CIM implementation, major functions in CIM, Benefits of CIM, Lean manufacturing, Just-in-time.

Text Books :

1. CAD / CAM Principles and Applications – 2nd edition, P.N. Rao, Tata Mc. Graw Hill
2.

REFERENCES :

1. CAD / CAM Theory and Practice / Ibrahim Zeid / TMH
2. CAD / CAM / CIM / Radhakrishnan and Subramanian / New Age
3. Principles of Computer Aided Design and Manufacturing / Farid Amirouche / Pearson
4. Computer Numerical Control Concepts and programming / Warren S Seames / Thomson.
5. CAD / CAM by CSP Rao – Hi-Tech Publishers.

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ROCKETS AND MISSILES
(ELECTIVE – II)

UNIT-I
SOLID PROPELLANT ROCKET SYSTEMS
Ignition system in rockets-Types of igniters-Igniter design considerations- Combustion system of solid rockets

UNIT-II
LIQUID PROPELLANT ROCKET SYSTEMS
Design consideration of liquid rocket combustion chamber, injector, propellant feed lines, valves, propellant tank outlet and helium pressurized and turbine feed systems- Propellant slosh - Propellant hammer- Geysering effect in cryogenic rocket engines

UNIT-III
AERODYNAMICS OF ROCKETS AND MISSILES
Airframe components of rockets and missiles- Forces acting on a missile while passing through atmosphere-Classification of missiles- Method of describingaerodynamic forces and moments-Lateral aerodynamic moment-Lateral damp ingmoment and longitudinal moment of a rocket-Lift and drag forces-Drag estimation- Body upwash and downwash in missiles-Rocket dispersion.

UNIT-IV
TWO-DIMENSIONAL ROCKET MOTION IN VACUUM
Equations of motion-Rocket Motion in free space (Tsiokovsky's equation, Rocket Parameters, Burnout range)-Rocket Motion in a homogeneous gravitational field(Vertical flight, Constant Pitch angle, Gravity turns)

UNIT-V
MULTI-STAGE ROCKET
Nomenclature of the multi-stage rocket-Ideal Velocity of the multi-stage rocket-Vertical ascent in a homogeneous gravitational field and in vacuum (Burnout velocity- Culmination altitude-Vertical ascent of a two-stage rocket)

UNIT-VI
ATTITUDE CONTROL OF ROCKETS AND MISSILES
Rocket thrust vector control - Methods of thrust vector control-Thrust magnitude control, Thrust Termination

UNIT-VII
SEPARATION SYSTEMS FOR ROCKETS AND MISSILES
Stage separation dynamics-Separation techniques

UNIT-VIII
MATERIALS FOR ROCKETS AND MISSILES
Criteria for Selection of materials for rockets and missiles-Choice of materials at cryogenic temperatures, extremely high temperatures - Requirement of materials for thermal protection and pressure vessels

TEXT BOOKS
1. "Rocket Propulsion Elements", George P. Sutton and Oscar Biblarz, Wiley- Interscience, 2000
2. "Rocket Propulsion and Spaceflight Dynamics", J.W. Cornelisse, H.F.R.Schoyer, and K.F.Wakker, Pitman, 1979

REFERENCES
1. "Missile Configuration Design", SS Chin, McGraw Hill, NY, 1961
2. "Space Vehicle Dynamics", K.J.Ball and G.F.Osborne, Oxford University Press, 1967
3. "Materials for Missiles and Spacecraft", E.R. Parker, McGraw Hill, 1982.

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PROPELLANT TECHNOLOGY
(ELECTIVE – II)

UNIT - I
LIQUID FUELS
Properties and tests for petroleum products - Motor gasoline - Aviation gasoline - Aviation turbine fuels - Requirements of aviation fuels of kerosene type and high flash point type - Requirements for fuel oils.

UNIT - II
SOLID PROPELLANTS – I
Single base propellants - Double base propellants - Composite propellants – CMBD propellants - Metallized composite propellants.

UNIT - III
SOLID PROPELLANTS – II
Introduction to different fuels and oxidizers of composite propellants – Brief introduction to composite theory of composite and double base propellants.

UNIT - IV
LIQUID PROPELLANTS – I
Various liquid propellants and their properties - Monopropellants and bipropellant system - concept of ullage - Ignition studies of liquid propellants.

UNIT - V
LIQUID PROPELLANTS – II
Propellant loading tolerances - inventory - Volume versus mass loading - Loading measurement and control - Outage control.

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UNIT –VI
CRYOGENIC PROPELLANTS – I
Introduction to cryogenic propellants - Liquid hydrogen, liquid oxygen, liquid nitrogen and liquid nitrogen and liquid helium and their properties.

UNIT –VII
CRYOGENIC PROPELLANTS – II
Theory behind the production of low temperature - Expansion engine – Cascade process - Joule Thompson effect - Magnetic effect - Ortho and para H2 - Helium 4 and Helium 3 - Ideal cycles and efficiency of cryo systems - Storing of cryogenic propellants - Cryogenic loading problems.

UNIT - VIII
PROPELLANT TESTING
Laboratory testing - Arc Image Furnace - Ignitability studies - Differential Thermal Analysis - Thermo-gravimetric analysis - Particle size measurement Micro-merograph - Strand burner tests impulse bomb - Performance estimation.

TEXT BOOKS
1. Cornelissse, J.W., Rocket Propulsion and Space Dynamics, J.W. Freeman & Co., Ltd., London, 1980.
2. Panrner, S.F. Propellant Chemistry, Reinhold Publishing Corp., N.Y 1985.

REFERENCES
1. Shutton, G.P., Rocket Propulsion Elements, John Wiley, 1993.
2. Sharma, S.P. and Mohan .C., Fuels and Combustion, Tata McGraw Hill Publishing Co, Ltd., 1984
3. Mathur, M., and Sharma, R.P., Gas Turbine and Jet and Rocket Propulsion, Standard Publishers, New Delhi, 1988.

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NEURAL NETWORKS AND FUZZY LOGIC
(ELECTIVE – II)

UNIT – I
INTRODUCTION TO NEURAL NETWORKS
Introduction, Humans and Computers, Organization of the Brain, Biological Neuron, Biological and Artificial Neuron Models, Hodgkin-Huxley Neuron Model, Integrateand- Fire Neuron Model, Spiking Neuron Model, Characteristics of ANN, McCulloch- Pitts Model, Historical Developments, Potential Applications of ANN.

UNIT- II
ESSENTIALS OF ARTIFICIAL NEURAL NETWORKS
Artificial Neuron Model, Operations of Artificial Neuron, Types of Neuron Activation Function, ANN Architectures, Classification Taxonomy of ANN – Connectivity, Neural Dynamics (Activation and Synaptic), Learning Strategy (Supervised, Unsupervised, Reinforcement), Learning Rules, Types of Application

UNIT–III
SINGLE LAYER FEED FORWARD NEURAL NETWORKS
Introduction, Perceptron Models: Discrete, Continuous and Multi-Category, Training Algorithms: Discrete and Continuous Perceptron Networks, Perceptron Convergence theorem, Limitations of the Perceptron Model, Applications.

UNIT- IV
MULTILAYER FEED FORWARD NEURAL NETWORKS
Credit Assignment Problem, Generalized Delta Rule, Derivation of Backpropagation (BP) Training, Summary of Backpropagation Algorithm, Kolmogorov Theorem, Learning Difficulties and Improvements.

UNIT V
ASSOCIATIVE MEMORIES
Paradigms of Associative Memory, Pattern Mathematics, Hebbian Learning, General Concepts of Associative Memory (Associative Matrix, Association Rules, Hamming Distance, The Linear Associator, Matrix Memories, Content Addressable Memory), Bidirectional Associative Memory (BAM) Architecture, BAM Training Algorithms:
Storage and Recall Algorithm, BAM Energy Function, Proof of BAM Stability Theorem Architecture of Hopfield Network: Discrete and Continuous versions, Storage and Recall Algorithm, Stability Analysis, Capacity of the Hopfield Network Summary and Discussion of Instance/Memory Based Learning Algorithms, Applications.

UNIT – VI
CLASSICAL & FUZZY SETS
Introduction to classical sets - properties, Operations and relations; Fuzzy sets, Membership, Uncertainty, Operations, properties, fuzzy relations, cardinalities, membership functions.

UNIT VII
FUZZY LOGIC SYSTEM COMPONENTS
Fuzzification, Membership value assignment, development of rule base and decision making system, Defuzzification to crisp sets, Defuzzification methods.

UNIT VIII
APPLICATIONS
Neural network applications: Process identification, control, fault diagnosis and load forecasting.
Fuzzy logic applications: Fuzzy logic control and Fuzzy classification.

TEXT BOOK:

1. Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications by Rajasekharan and Rai – PHI Publication.
2. Introduction to Artificial Neural Systems - Jacek M. Zuarda, Jaico Publishing House, 1997.

REFERENCES:

1. Neural and Fuzzy Systems: Foundation, Architectures and Applications, - N. Yadaiah and S. Bapi Raju, Pearson Education
2. Neural Networks – James A Freeman and Davis Skapura, Pearson, 2002.
3. Neural Networks – Simon Hykins , Pearson Education
4. Neural Engineering by C.Eliasmith and CH.Anderson, PHI
5. Neural Networks and Fuzzy Logic System by Bork Kosk, PHI Publications.

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COMPUTATIONAL STRUCTURAL AND AERODYNAMIC ANALYSIS LAB

A. FINITE ELEMENTS METHOD LAB

UNIT-I

One of the following

a) Exercises on discretization
b) Grid generation and element/node numbering

UNIT-II

Element Generation Exercises (two of the following) 1-D elements(rods, shafts and beams)
Plane Stress /Plane Strain Quadrilateral elements Triangular plate elements

UNIT-III

FEM Solutions using any one of the following
MATLAB
ANSYS
NASTRAN
PRO - E
Any one of the normal procedures:

a) Gauss Quadrature for unit 1 and 2-D domes
b) Generation of stiffness and load vector matrices.
c) Use of eigen value solvers for frequency and mode shapes determination

B. CFD LAB

UNIT – I

Numerical solutions for any one of the following, using Finite difference method.
Elliptic Equations
Parabolic Equations
Hyperbolic Equations

UNIT – II

Grid Generations for any one of the following
Algebraically stretched Cartesian grids.
Elliptic grids

UNIT – III

Numerical solutions for any one of the following
Vortex panel method
Source panel method
Incompressible coutte flow
Supersonic flow over a flat plate
Grid Generation of Aerofoil NACA 0012

Equipment Needed

1 Computers P-IV with 512 MB RAM and parallel processing computational facility 60 Nos / 60 students a batch.
2. 60 educational version licenses of a) MAT lab b) Ansys c) NASTRAN d) Pro – e e) FLUENT OR STAR CD or CFX

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STRUCTURAL ANALYSIS AND DETAILED DESIGN LAB

Design and Analysis of the following Aircraft Components:-

1. Landing Gear
2. Wings
3. Fuselage
4. Propeller Shaft
5. Propeller Blades
6. Nose Cone

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AIRCRAFT SYSTEMS AND INSTRUMENTATION

UNIT – I
FLIGHT CONTROL SYSTEMS
Principles of flight control, flight control surfaces, control surface actuation, flight control linkage systems, trim and feel. Power control, mechanical, direct drive, electromechanical, electro-hydrostatic actuation ,multiple redundancy. The fly by wire system. Airbus and Boeing implementations. Inter-relationship of flight control, guidance and vehicle management systems.

UNIT – II
ENGINE CONTROL SYSTEMS
The engine control problem, fuel flow control, air flow control, control system parameters, example systems, design criteria. Engine starting, fuel control, ignition control, engine rotation, throttle levers, engine indications. Engine control on a modern civil aircraft. Integrated flight and propulsion control.

UNIT – III
FUEL SYSTEMS
Characteristics of aircraft fuel systems, fuel system components, fuel transfer pumps, fuel booster pumps, fuel transfer valves, non return valves. Fuel quantity measurement systems, level sensors, fuel gauging probes. Fuel system operation, fuel pressurisation, engine feed, fuel transfer, use of fuel as heat sink, external fuel tanks, fuel jettison, in-flight refuelling. Integrated civil aircraft fuel systems.

UNIT – IV
HYDRAULIC SYSTEMS
Importance of hydraulic systems, functions to be performed, the hydraulic circuit, actuation, the hydraulic fluid, hydraulic piping, hydraulic pump, fluid conditioning, the reservoir, emergency power sources. Aircraft applications, examples of B Ae, Airbus, Boeing implementations. The landing gear system for retraction, steering, braking and anti-skid.

UNIT - V
ELECTRICAL SYSTEMS
Aircraft electrical system characteristics, power (AC and DC) generation. Power generation control, voltage regulation, parallel operation, supervisory and protection functions. Modern electrical power generation types, constant frequency, variable frequency, variable speed constant frequency types. Primary power distribution, power conversion and energy storage. Secondary power distribution, power switching, load protection. Electrical loads, motors and actuators, lighting, heating, subsystem controllers, ground power. Emergency power generation. Electrical load management system.

UNIT – VI
PNEUMATIC SYSTEMS AND ENVIRONMENTAL CONTROL SYSTEMS.
Use of pneumatic power in aircraft. Sources of pneumatic power, the engine bleed air, engine bleed air control. Users of pneumatic power, wing and engine anti-ice, engine start, thrust reversers, hydraulic system, pitot static systems.

The need for controlled environment in aircraft. Sources of heat. Environmental control system design, ram air cooling, fuel cooling, engine bleed, bleed flow and temperature control. Refrigeration systems, air cycle and vapour cycle systems, turbo fan, boot strap, reversed boot strap systems. Humidity control. Air distribution systems. Cabin pressurisation, g tolerance, rain dispersal, anti-misting and demisting.

UNIT VII
AIRCRAFT INSTRUMENTATION - SENSORS AND DISPLAYS
Air data sensors, magnetic sensing, inertial sensing, radar sensors. The electromechanical instrumented flight deck, early flight deck instruments, attitude direction indicator, horizontal situation indicator, altimeter, airspeed indicator. Advanced flight deck display system architectures, display systems, display media, future flight deck displays.

UNIT VIII
SYSTEMS DESIGN AND DEVELOPMENT
System design, specifications and requirement, regulations, guidelines and certification. Safety processes, functional hazard analysis, preliminary systems safety analysis, system safety analysis, common cause analysis. Requirements capture, top-down approach and bottoms-up approach. Fault tree analysis, failure mode and effects analysis, component reliability, dispatch reliability, Markov analysis.
Development processes, software and hardware. Product life cycle phases - concept, definition, design, build, test, operate and disposal or refurbish. Major review processes. Software development process, verification and integration with hardware.

TEXT BOOKS

Aircraft Systems: Mechanical, Electrical and Avionics Subsystems Integration,, Moir, I. and Seabridge, A., AIAA (American Institute of Aeronautics & Astronautics) 2001

Civil Avionics Systems, , Moir, I. and Seabridge, A., AIAA (American Institute of Aeronautics & Astronautics) 2002

REFERENCES

Ground Studies for Pilots: Flight Instruments and Automatic Flight Control Systems, , Harris, D., Blackwell Science, ISBN 0-632-05951-6 sixth edition 2004.

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SYSTEM MODELING AND SIMULATION
(ELECTIVE – III)

UNIT I
BASIC CONCEPTS
Hierarchy Types – Elements of a system – system description – Modeling definition – Functions, classification.

UNIT II
SIMULATION
Structure of Simulation Models – Modeling approaches – System simulation – Definition – The Simulation process – Advantages

UNIT III
TECHNIQUES FOR RANDOM NUMBER GENERATION
Simulation of random phenomena – Monte-Carlo sampling – Random number generation – Mid square method – Mid product method – Multiplicative congruential method – Additive congruential method,

UNIT IV
RANDOMNESS TESTING
Testing for randomness – Chi-square method – Kolmogrov method – Runs test – Gasp test.

UNIT V
DATA PREPARATION
Correlation and regression analysis – Curve fitting – Fitting of known distributions – Uniform, normal, exponential Poisson, Weibull empirical distribution – Time flow mechanism – Flow diagram

UNIT VI
SIMULATION OF DISCRETE SYSTEM – I
Simulation of an event occurrence using random number table – Simulation of component failure using exponential and Weibull models Simulation of single server and two server queue – Simulation of an inventory system.

UNIT VII
SIMULATION OF DISCRETE SYSTEM – II
Planning of simulation experiments – Tactical planning – Run length determination – Validation of simulation models – Analysis of simulation results

UNIT VIII
SIMULATION LANGUAGES
Introduction – Basic Concepts and Advantages of GPSS – Case Example – Basic concepts and advantages of SIMSCRIPT – Case example.

TEXT BOOKS
1 “System Simulation with Digital Computers”, Narasingh Deo, PHI, 1979.
2 “System Simulation”, Geoffrey Gordon, PHI, 1995.

REFERENCES
1 “Discrete Event System Simulation”, Jerry Banks, John S. Carson and Baryl nelson., PHI, 1996.

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ADVANCED COMPUTATIONAL AERODYNAMICS

(ELECTIVE – III)

UNIT - I
PANEL METHODS
Introduction to panel method, Basic aspects of uniform source and vortex flows, Source panel method – Non-lifting flows over arbitrary two-dimensional bodies.

UNIT – II
VORTEX PANEL METHOD
Vortex panel method – Lifting flows over arbitrary two-dimensional bodies.

UNIT – III
METHOD OF CHARACTERISTICS
Introduction to numerical techniques for steady supersonic flows, Philosophy of method of characteristics. Determination of characteristic lines – Two-dimensional irrotational flow. Determination of the compatibility equation and unit processes. Regions of influence and Domains of dependence.

UNIT – IV
APPLICATIONS OF METHOD OF CHARACTERISTICS
Supersonic nozzle design using method of characteristics - Description of Mc Cormack's predictors - Corrector techniques.

UNIT - V
TRANSONIC RELAXATION METHOD
Theoretical aspects of transonic flows, Small Perturbation flows - Transonic small perturbation equations - Central and Backward difference schemes, Shock capturing vs. shock fitting techniques: Conservation vs. non conservation forms of governing equations, Line relaxation techniques.

UNIT - VI
BOUNDARY LAYER EQUATION
Introduction to boundary layer equations and their solutions. Description of the boundary layer equations. Transformation of boundary layer equations and the numerical solution method. Choice of discretization model and the generalized Crank- Nicholson Scheme. Discretization of boundary layer equations and illustration of solutions of a tridiagonal system of linear algebraic equations.

UNIT - VII
TIME DEPENDENT METHODS – I
Stability of Solution, Explicit time dependent methods - Euler, Backward Euler, One step trapezoidal, Backward differencing, methods, Leap Frog method.

UNIT – VIII
TIME DEPENDENT METHODS – II
Description of Lax-Wendroff Scheme and Mac Cormack's two-step predictor – Corrector method. Description of time split methods and Approximate factorization schemes

TEXT BOOKS

1. John .D. Anderson " Computational Fluid Dynamics", McGraw Hill
2. Anderson, Dale A., John C. Tanhill and Richard H.P Letcher, "Computational Fluid Mechanics and Heat transfer", McGraw Hill, New York 1984, Volumes I & II.

REFERENCES

1. Hoffmann, K.A: Computational Fluid Dynamics for Engineers, Engineering Education System, Austin, Tex., 1989
2. Kreyszig, E., Advanced Engineering Mathematics, Wiley, New York
3. Introduction to Computational Fluid Dynamics, Chow CY, John Wiley, 1979
4. Bose, T.K., Computation Fluid Dynamics, Wiley Eastern Ltd., 1988.
5. Chow, C.Y., Introduction to Computational Fluid Dynamics, John Wiley, 1979.
6. Hirsch, A.A., Introduction to Computational Fluid dynamics, Mcgraw Hill, 1989.
7. Fletcher, Computational Fluid Dynamics, Vol I & II, Springer Verlag, 1993.
8. Patankar, S.V., Numerical heat Transfer and Fluid Flow. Hemispher Publishing Corporation, 1992.

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HELICOPTER ENGINEERING
(Elective-III)

UNIT - I
ELEMENTS OF HELICOPTER AERODYNAMICS
Configurations based on torque reaction - Jet rotors and compound helicopters.

UNIT – II
ROTOR CONTROL
Methods of control - Collective and cyclic pitch changes - Lead-lag and flapping hinges.

UNIT - III
IDEAL ROTAR THEORY
Hovering performances - Momentum and simple blade element theories.

UNIT – IV
ROTOR PERFORMANCE
Figures of merit - Profile and induced power estimation - Constant chord and ideal twist rotors.

UNIT - V
POWER ESTIMATES
Induced, Profile and Parasite power requirements in forward flight - Performances curves with effects of altitude.

UNIT – VI
STABILITY AND TRIM
Preliminary ideas on helicopter stability.

UNIT - VII
LIFT AND CONTROL OF V/STOL AIRCRAFT
Various configuration - Propeller, Rotor ducted fan and jet lift - Tilt wing and vectored thrust - Performances of VTOL and STOL aircraft in hover, Transition and Forward motion.

UNIT - VIII
GROUND EFFECT MACHINES
Types - Hover height, Lift augmentation and power calculations for plenum chamber and peripheral jet machines - Drag of hovercraft on land and water. Applications of hovercraft.

TEXT BOOKS
1. Johnson, W., Helicopter Theory, Princeton University Pres, 1980.
2. McCormick, B.W., Aerodynamics, Aeronautics & Flight Mechanics John Wiley, 1995

REFERENCES
1. Gessow, A., and Myers, G.C., Aerodynamics of Helicopter, Macmillan & Co., N.Y.1987.
2. McCormick, B.W., Aerodynamics of V/STOL Flight, Academics Press, 1987
3. Gupta, L Helicopter Engineering, Himalayan books, 1996.

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HYPERSONIC AERODYNAMICS
(ELECTIVE-III)

UNIT-I - FUNDAMENTALS OF HYPERSONIC FLOWS
Importance/properties of hypersonic flow-Basic equations boundary conditions for inviscid flow, shock wave shapes, flow over a wedge

UNIT-II - HYPERSONIC APPROXIMATIONS
Prandtl-Meyer flow- Axi-symmetric flow over a cone - Flow over a flat plate

UNIT-III - HYPERSONIC SMALL DISTURBANCE THEORY
Flow over a wedge and a cone- Blast wave analogy,-Newtonian impact theory- Busemann centrifugal correction -Shock expansion method- Tangent cone and tangent wedge methods

UNIT-IV - BASIC ASPECTS OF HYPERSONIC VISCOUS FLOWS
Introduction to viscous flow and pressure interactions over a flat plate- Boundary layers

UNIT-V - HYPERSONIC AERODYNAMIC HEATING
Reference temperature method-Entropy layer effects on aerodynamic heating

UNIT-VI - HYPERSONIC VISCOUS INTERACTIONS
Strong and weak interactions-Shock wave/ boundary layer interactions

UNIT-VII - HYPERSONIC VEHICLE DESIGN
Hypersonic propulsion and vehicle design

UNIT-VIII - RAREFIED GAS DYNAMICS
Rarefied flow regimes-Kinetic theory of gases-Gas-surface interaction- Aerodynamic forces in hypersonic free molecular flow around simple geometries

TEXT BOOKS
1. “Hypersonic and High Temperature Gas Dynamics”, Anderson, J.D,McGraw-Hill, 1989.
2. “Hypersonic Aerothermodynamics”, Bertin, J.J., AIAA, 1994.

REFERENCES
1. “Introduction to Hypersonic flow”, Cherni C G, Academic Press,1961
2. “Hypersonic Flow Theory”, Hayes W D and Problein R F, Academic Press 1959
3. “Elements of Hypersonic Aerodynamics”, Cox R N and Crabtree L P, London 1965

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SPACE MECHANICS
(ELECTIVE-III)

UNIT-I
BASIC CONCEPTS
The solar system-Reference frames and coordinate systems-The celestial sphere- The ecliptic-Motion of vernal equinox-Sidereal time-Solar Time-Standard Time-The earth's atmosphere

UNIT-II
THE GENERAL N-BODY PROBLEM
The many body problem-Lagrange-Jacobi identity-The circular restricted three- body problem-Libration points-Relative Motion in the N-body problem

UNIT-III
THE TWO-BODY PROBLEM
Equations of motion-General characteristics of motion for different orbits-Relations between position and time for different orbits-Expansions in elliptic motion-Orbital Elements-Relation between orbital elements and position and velocity

UNIT-IV
THE LAUNCHING OF A SATELLITE
Launch vehicle ascent trajectories-General aspects of satellite injection-Dependence of orbital parameters on in-plane injection parameters-Launch vehicle performances- Orbit deviations due to injection errors

UNIT-V
PERTURBED SATELLITE ORBITS
Special and general perturbations- Cowell's Method-Encke's method-Method of variations of orbital elements-General perturbations approach

UNIT-VI
INTERPLANETARY TRAJECTORIES
Two-dimensional interplanetary trajectories-Fast interplanetary trajectories-Threedimensional interplanetary trajectories-Launch of interplanetary spacecraft-Trajectory about the target planet

UNIT-VII
BALLISTIC MISSILE TRAJECTORIES
The boost phase-The ballistic phase-Trajectory geometry-Optimal flights-Time of flight-Re-entry phase-The position of the impact point-Influence coefficients.

UNIT-VIII
LOW-THRUST TRAJECTORIES
Equations of Motion-Constant radial thrust acceleration-Constant tangential thrust(Characteristics of the motion, Linearization of the equations of motion- Performance analysis

TEXT BOOKS
1. "Rocket Propulsion and Spaceflight Dynamics", J.W.Cornelisse, H.F.R. Schoyer, and K.F. Wakker, Pitman, 1979
2. "Spaceflight Dynamics", William E.Wiesel, McGraw-Hill, 1997

REFERENCES
1. "Spacecraft Mission Design", Charles D.Brown, AIAA Education Series, Published by AIAA, 1998
2. "Orbital Mechanics", Vladimir A. Chobotov, AIAA Education Series, AIAA Education Series, Published by AIAA, 2002
3. "Fundamentals of Astrodynamics and Applications", David.A. Vellado, Microcosm and Kluwer, 2001

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FATIGUE AND FRACTURE MECHANICS
(ELECTIVE-IV)

UNIT - I - FATIGUE OF STRUCTURES
S-N Curves - Endurance limit - Effect of mean stress - Notches and stress concentrations - Neuber's stress concentration factors - Plastic stress concentration factor - Notched S-N curves.

UNIT - II - DESIGN OF COMPONENTS
Goodman, Gerber and Soderberg relations and diagrams – Modified Goodman Diagram – Design of components subjected to axial, bending, torsion loads and combination of them.

UNIT - III - STATISTICAL ASPECTS OF FATIGUE BEHAVIOUR
Low cycle and high cycle fatigue - Coffin - Manson's relation – Transition life – Cyclic strain hardening and softening.

UNIT – IV - LOAD ASPECTS
Analysis of load histories - Cycle counting techniques - Cumulative damage - Miner's theory - Other theories.

UNIT - V - PHYSICAL ASPECTS OF FATIGUE
Phase in fatigue life - Crack initiation - Crack growth - Final fracture - Dislocations - Fatigue fracture surfaces.

UNIT - VI - FRACTURE MECHANICS
Strength of cracked bodies - Potential energy and surface energy - Griffith's theory - Irwin-Orwin extension of Griffith's theory to ductile materials.

UNIT – VII - STRESS ANALYSIS
Stress analysis of cracked bodies - Effect of thickness on fracture toughness – Stress intensity factors for typical geometries. Introduction of finite element approach for crack propagation studies.

UNIT – VIII - FATIGUE DESIGN AND TESTING
Safe life and fail-safe design philosophies – Importance of fracture mechanics in aerospace structure - Application to composite materials structures.

TEXT BOOK
1. Knott, J.F., Fundamentals of Fracture Mechanics, Butter Worth & Co.,
(Publishers) Ltd., London, 1983

REFERENCES
1. Barrois, W., and Ripley, E.L., Fatigue of Aircraft Structures, Pergamon Pres., Oxford, 1983.
2. Sih, C.G., Mechanics of Fracture, Vol. I, Sijthoff and Noordhoff International Publishing Co., Netherlands, 1989.
3. "Mechanical Engineering Design" by J E Shigley.

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BOUNDARY LAYER THEORY
(ELECTIVE-IV)

UNIT – I
BASIC LAWS
Basic laws of fluid flow – Continuity, momentum and energy equations as applied to system and control volume – Concept of flow fields.

UNIT – II
FUNDAMENTALS OF BOUNDARY LAYER THEORY
Viscous fluid flow – Boundary conditions – Development of boundary layer – Estimation of boundary layer thickness – Displacement thickness, momentum and energy thickness for two-dimensional flows. General stress system in a deformable body – General strain system.

UNIT - III
NAVIER STOKES EQUATION
Relation between stress and strain system in a solid body (Hooke's Law) – Relation between stress and strain rate system in liquids and gases (Stroke's Law) – The Navier - Strokes Equation (N-S) – General properties of Navier - Stokes Equation.

UNIT- IV
EXACT SOLUTION OF N-S EQUATION
Two dimensional flow through a straight channel, Hagen –Poiseulle flow – Suddenly accelerated plane wall – Flow near a rotating disk – Very slow motion: Parallel flow past a sphere.

UNIT - V
LAMINAR BOUNDARY LAYER
Analysis of flow past a flat plate and a cylinder – Integral relation of Karman – Integral analysis of energy equation – Laminar boundary layer equations – Flow separation – Blasius solution for flat–plate flow – Boundary layer temperature profiles for constant plate temperature.

UNIT – VI
BOUNDARY LAYER METHODS
Falkner Skan Wedge flows – Integral equation of Boundary layer – Pohlhausen method – Thermal boundary calculations – One parameter and two parameter integral methods.

UNIT – VII
INCOMPRESSIBLE TURBULENT MEAN FLOW
Two-dimensional turbulent boundary layer equations – Integral relations – Eddyviscosity theories – Velocity profiles.

UNIT – VIII
COMPRESSIBLE – BOUNDARY LAYER FLOW
The law of the wall – The law of the wake – Turbulent flow in pipes and channels – Turbulent boundary on a flat plate – Boundary layers with pressure gradient.

TEXT BOOKS
1. "Turbulent Flows in Engineering", Reynolds AJ, John Wiley & Sons, 1980
2. "Incompressible Flow", Panton RL, John Wiley & Sons, 1984

REFERENCES
1. "Boundary Layer Theory", Schlichting H, McGraw Hill, New York, 1979
2. "Viscous fluid Flow", White FM, McGraw Hill Co. Inc., NY, 1991, 2nd Edition
3. "Fundamentals of Aerodynamics", Anderson JD, McGraw Hill Book Co., Inc., NY, 2001, 3rd Edition.

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AIRCRAFT MAINTENANCE MANAGEMENT
(ELECTIVE-IV)

UNIT-I
NECESSITY TO DO MAINTENANCE
Role of engineer-Role of mechanic-types of maintenance-reliability-redesign-failure rate patterns-establishing a maintenance program

UNIT-II
DEVELOPMENT OF MAINTENANCE PROGRAMS
Maintenance steering group approach-process oriented maintenance-task oriented maintenance-maintenance program documents-maintenance intervals-changing basic intervals-Goals and objectives of in maintenance-maintenance program content

UNIT-III
CERTIFICATION REQUIREMENTS & DOCUMENTATION FOR MAINTENANCE
Aircraft certification-delivery inspection-operator certification-certification of personnel-aviation industry interaction; Manufacture's documentation-Regulatory documentation-Airline generated documentation

UNIT-IV
MAINTENANCE AND ENGINEERING ORGANIZATION
M&E organizational chart-manager level functions-organizational structure-variation of the typical organization

UNIT-V
PRODUCTION PLANNING AND CONTROL
Forecasting-production planning-production control-feedback for planning

UNIT-VI
LINE MAINTENANCE, HANGAR MAINTENANCE & MAINTENANCE OVERHAUL SHOPS
Makeup of line maintenance-maintenance center responsibilities-line operations-aircraft logbooks-ramp and terminal operations-line station activities; Organization of hangar maintenance-problem areas of hangar maintenance-maintenance support shops-ground support equipment-a typical C check; Organization of overhaul shops-operation of overhaul shops-shop data collection

UNIT-VII
QUALITY CONTROL & QUALITY ASSURANCE
Quality control organization-basic inspection policies-requirement for quality assurance-quality audits-ISO 9000 standards-technical records

UNIT- VIII
RELIABILITY, MAINTENANCE SAFETY &TROUBLE SHOOTING
Types of reliability- typical reliability program-administration of reliability program; Industrial safety-safety regulations-maintenance safety program-accident and injury reporting; 3 levels of trouble shooting-knowledge of malfunctions-building a knowledge base-understanding the sequence of events-8 concepts of trouble shooting

TEXT BOOK
Harry A Kinnison, and Harry Kinnison, "Aviation Maintenance Management", McGraw-Hill, 2004

REFERENCES
C.H.Friend, "Aircraft Maintenance management", Longman, 1992

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HEAT TRANSFER
(ELECTIVE-IV)

UNIT – I

Introduction: Modes and mechanisms of heat transfer – Basic laws of heat transfer –General discussion about applications of heat transfer.

Conduction Heat Transfer:

Fourier rate equation – General heat conduction equation in Cartesian, Cylindrical and Spherical coordinates.

UNIT – II

Simplification and forms of the field equation – steady, unsteady and periodic heat transfer – Initial and boundary conditions.

One Dimensional Steady State Conduction Heat Transfer:

Homogeneous slabs, hollow cylinders and spheres – overall heat transfer coefficient – electrical analogy – Critical radius of insulation

One Dimensional Steady State Conduction Heat Transfer:

Variable Thermal conductivity – systems with heat sources or Heat generation
Extended surface (fins) Heat Transfer – Long Fin, Fin with insulated tip and Short
Fin, Application to error measurement of Temperature

UNIT III

One Dimensional Transient Conduction Heat Transfer:

Systems with negligible internal resistance – Significance of Biot and Fourier Numbers - Chart solutions of transient conduction systems- Concept of Functional Body

UNIT – IV

Convective Heat Transfer:

Classification of systems based on causation of flow, condition of flow, configuration of flow and medium of flow – Dimensional analysis as a tool for experimental investigation – Buckingham ˙ Theorem and method, application for developing semi – empirical non- dimensional correlation for convection heat transfer – Significance of non-dimensional numbers – Concepts of Continuity, Momentum and Energy Equations.

Forced convection: External Flows:

Concepts about hydrodynamic and thermal boundary layer and use of empirical correlations for convective heat transfer -Flat plates and Cylinders

Internal Flows:

Concepts about Hydrodynamic and Thermal Entry Lengths – Division of internal flow based on this –Use of empirical relations for Horizontal Pipe Flow and annulus flow.

UNIT – V

Free Convection: Development of Hydrodynamic and thermal boundary layer along a vertical plate - Use of empirical relations for Vertical plates and pipes.

UNIT VI

Heat Transfer with Phase Change:

Boiling: – Pool boiling – Regimes – Calculations on Nucleate boiling, Critical Heat flux and Film boiling.

Condensation: Film wise and drop wise condensation –Nusselt's Theory of Condensation on a vertical plate - Film condensation on vertical and horizontal cylinders using empirical correlations.

UNIT VII

Heat Exchangers:

Classification of heat exchangers – overall heat transfer Coefficient and fouling factor – Concepts of LMTD and NTU methods - Problems using LMTD and NTU methods.

UNIT VIII

Radiation Heat Transfer :

Emission characteristics and laws of black-body radiation – Irradiation – total and monochromatic quantities – laws of Planck, Wien, Kirchoff, Lambert, Stefan and Boltzmann– heat exchange between two black bodies – concepts of shape factor – Emissivity – heat exchange between grey bodies – radiation shields – electrical analogy for radiation networks.

Tables/Codes: Heat and Mass transfer data book / C.P. Kothandaraman,
Subramanian/ New Age Pub.

TEXT BOOKS :

1. Heat Transfer – Ghoshdastidar – Oxford University Press – II Edition
2. Heat Transfer – P.K.Nag/ TMH

REFERENCES:

1. Fundamentals of Engg. Heat and Mass Transfer / R.C.SACHDEVA / New Age International
2. Essential Heat Transfer - Christopher A Long / Pearson Education
3. Heat Transfer – A Practical Approach – Yunus Cengel, Boles / TMH
4. Heat and Mass Transfer – D.S.Kumar / S.K.Kataria & Sons
5. Heat Transfer / HOLMAN/TMH
6. Fundamentals of Heat Transfer & Mass Transfer- Incropera & Dewitt / John Wiley Pub.
7. Engineering Heat and Mass Transfer – Sarit K. Das / Dhanpat Rai Pub.
8. Heat and Mass Transfer – R. Yadav /CPH

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AEROELASTICITY
(ELECTIVE-IV)

OBJECTIVE:
To elucitate the aero elastic Phenomena, formulations and solutions techniques for aerospace vehicles in flight and to incorporate the spin off benefits.

UNIT I
Introduction to Aero elasticity COLLARS Triangle, Aerodynamics and interactions of Structural and Inertial forces Static and Dynamic Aero Elasticity Phenomena.

UNIT II
Simple Two dimensional idealization of flow, String Theory, Fredholm Integral equations of Second Kind Exact Solutions for simple rectangular wings.

UNIT III
Formulations of Structural Dynamics Equation and Coupling effects for panels and plates, Generalized coordinates, Lagrange's Equations of motion Hamilton's Principle Orthogonality conditions.

UNIT IV
Static Aero elastic Studies Divergences, control reversal, Aileron reversal speed, Aileron efficiency, lift distribution, Rigid and elastic wings.

UNIT V
Nondimentional Parameters, stiffness criteria, dynamic mass balancing - model experiments and dimensional similarity – flutter analysis.

UNIT VI
Formulation of Aero elastic Equations for a Typical Section, Quasi Steady Aerodynamic derivatives, modal equations Galerkins method of analysis.

UNIT VII
Stability of motion of Continua Torsion flexure flutter – Solution of flutter determinant, method of determining the classical flutter speed – Flutter Prevention and control.

UNIT VIII

Application of Aero Elasticity in Engineering Problems – Galloping of transmission lines, flow induces vibrations of tall slender structures and suspension Budges.

Text Books:

1. Fung Y.C. an introduction to the Theory of Aeroelasticity John Wiley and Sons, New York, 1985.
2. Bisphlinghoft R. C. Ashlay. H and Halfmam. R Aero-elasticity – Addition Werley Publishing Company.
3. Scnlan R.H. and Rosenbaum. R Introduction to the study of Aircraft Vibrations and Flutter McGraw Company New York 1981.

References:

Bisphlinghoft R. C. and Ashely, Principles of Aeroelasticity Johnwiley Company. 1998.

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INDUSTRY ORIENTED MINI PROJECT

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PROJECT WORK

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COMPREHENSIVE VIVA